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THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY

INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

(BEING A CONTINUATION OF THE 'ANNALS' COMBINED WITH LOUDON AND
CHARLESWORTH'S 'MAGAZINE OF NATURAL HISTORY.')

CONDUCTED BY

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"Omnes res creatæ sunt divinæ sapientiæ et potentiæ testes, divitiæ felicitatis humanæ :—ex harum usu *bonitas* Creatoris; ex pulchritudine *sapientia* Domini; ex œconomiâ in conservatione, proportione, renovatione, *potentia* majestatis elucet. Earum itaque indagatio ab hominibus sibi relictis semper æstimata; à verè eruditis et sapientibus semper exculta; malè doctis et barbaris semper inimica fuit."—LINNÆUS.

"Quelque soit le principe de la vie animale, il ne faut qu'ouvrir les yeux pour voir qu'elle est le chef-d'œuvre de la Toute-puissance, et le but auquel se rapportent toutes ses opérations."—BRUCKNER, *Théorie du Système Animal.* Leyden, 1767.

. . . The sylvan powers
Obey our summons; from their deepest dells
The Dryads come, and throw their garlands wild
And odorous branches at our feet; the Nymphs
That press with nimble step the mountain thyme
And purple heath-flower come not empty-handed,
But scatter round ten thousand forms minute
Of velvet moss or lichen, torn from rock
Or rifted oak or cavern deep: the Naiads too
Quit their loved native stream, from whose smooth face
They crop the lily, and each sedge and rush
That drinks the rippling tide: the frozen poles,
Where peril waits the bold adventurer's tread,
The burning sands of Borneo and Cayenne,
All, all to us unlock their secret stores
And pay their cheerful tribute.

J. TAYLOR, *Norwich*, 1818.

ALERE FLAMMAM

CONTENTS OF VOL. XV.

[SECOND SERIES.]

NUMBER LXXXV.

Page

I. Notes of an Excursion to the South of France and the Auvergne in search of *Diatomaceæ*. By the Rev. WILLIAM SMITH, F.L.S., Professor of Natural History, Queen's College, Cork. (With a Plate.) 1

II. Amended Characters of the singular Lymneadous Genus *Camptoceras*, and description of a new *Ancylus*, inhabitants of North-western India. By W. H. BENSON, Esq. 9

III. Characters of the Genus *Opisthoporus*, an Eastern form of the *Cyclostomacea*, with Remarks on its Affinities and Notes on several Opercula. By W. H. BENSON, Esq. 13

IV. On Artificial Sea Water. By PHILIP H. GOSSE, A.L.S. . . . 17

V. Notes on Swiss Mollusca. By J. GWYN JEFFREYS, Esq., F.R.S. 20

VI. Sketch of the Life of the late Professor Edward Forbes. By J. H. BALFOUR, M.D., Professor of Botany, Edinburgh 35

New Books.—The Entomologist's Annual for 1855. Edited by H. T. Stainton.—A Catalogue of British Fossils, by John Morris. Second Edition.—Popular Conchology, by Agnes Catlow. Second Edition 53–63

Proceedings of the Zoological Society 64–76

Note on the Reproduction of *Lingula*, by M. Brullé; Description of the Animal of *Cyclina sinensis*, by Dr. J. E. Gray; Observations on the Development of *Actinia*, by M. Lacaze-Duthiers; Meteorological Observations and Table 76–80

NUMBER LXXXVI.

VII. Some Account of the *Actiniadæ* found upon the coast near Teignmouth, Devon. By ROBERT C. R. JORDAN, M.B. Lond., Professor of Comparative Anatomy, Queen's Coll. Birmingham 81

Page

VIII. On a Monstrous Oyster-Shell. By GEORGE BUSK, Esq. (With a Plate.) 91

IX. On *Hypericum anglicum*. By CHARLES C. BABINGTON, M.A., F.R.S &c 92

X. On the Ornithology of Malacca. By A R. WALLACE, Esq. ... 95

XI. Descriptions of the Animals of certain Genera of Bivalve Shells. By S. P WOODWARD, Esq., F G S. 99

XII. On Fossil Echinoderms from the Island of Malta; with Notes on the stratigraphical distribution of the Fossil Organisms in the Maltese Beds. By THOMAS WRIGHT, M.D. &c. (With four Plates.) 101

XIII. Notes on British Zoophytes, with descriptions of new species. By the Rev THOMAS HINCKS, B A. (With two Plates) 127

XIV On the Marine Vivarium. By C. S. HARRIS, Esq 130

Proceedings of the Zoological Society, Linnæan Society; Royal Society; Botanical Society of Edinburgh .... 134—157

Observations on the Nests of Humming Birds, by John Gould, F.R S. &c.; On a Marsupial Frog (*Notodelphys ovifera*) from Venezuela, by Dr D. F. Weinland; Descriptions of two new species of *Ptilonopus*, by George Robert Gray, F.L S. & F.Z.S.; Meteorological Observations and Table .... 157—160

NUMBER LXXXVII.

XV. A Monograph of the Indian species of *Phylloscopus* and its immediate affines. By EDWARD BLYTH, Esq. 161

XVI On Fossil Echinoderms from the Island of Malta; with Notes on the stratigraphical distribution of the Fossil Organisms in the Maltese Beds. By THOMAS WRIGHT, M.D. &c. 175

XVII. On the Genera *Pionandra*, *Cliocarpus* and *Pœcilochroma*. By JOHN MIERS, Esq., F.R.S., F.L.S. &c. 196

XVIII. On the Discovery of Viviparous Fish in Louisiana. By B. DOWLER, M D. 206

XIX. On the Anomalous Oyster-Shell described in the 'Annals' for February. By Dr J E. GRAY 210

XX. On *Actinophrys Sol*. By E. CLAPARÈDE. (With a Plate.) 211

Proceedings of the Zoological Society; Royal Society; Botanical Society of Edinburgh .... 218—237

Page
On the Movements and Reproduction of the *Naviculæ*, by M. Focke; On *Lottia zebrina* and *L. Scurra*, by Dr J. E Gray; Description of a new species of *Sorex* from India, by R. Templeton; Meteorological Observations and Table .... 237—240

NUMBER LXXXVIII.

XXI. A Comparative View of the more important Stages of Development of some of the higher Cryptogamia and the Phanerogamia. By Charles Jenner 241

XXII Observations on the Natural History and Habits of the Common Prawn, *Palæmon serratus*. By Robert Warington, Esq. 247

XXIII. Report on a Collection of *Diatomaceæ* made in the district of Braemar by Professor Balfour and Mr. George Lawson. By R. K. Greville, LL D &c (With a Plate) 252

XXIV. On Fossil Echinoderms from the Island of Malta; with Notes on the stratigraphical distribution of the Fossil Organisms in the Maltese Beds By Thomas Wright, M.D. &c. 262

XXV On *Monopus medusicola*, a species of Leech By Philip Henry Gosse, A.L S (With a Plate.) 277

XXVI. On *Ancylus oblongus* and *A fluviatilis*. By William Clark, Esq 278

XXVII. On *Actinophrys Sol* By E Claparède 285

Proceedings of the Royal Society, Zoological Society, Linnæan Society; Botanical Society of Edinburgh .... 291—313

On the Anomalous Oyster-Shell, by Prof J. S. Henslow; Description of a new species of *Corynactis*, by William Thompson, On the Species confounded under the name of *Laminaria digitata*, with some Observations on the genus *Laminaria*, by M. A. Le Jolis; Descriptions of two new species of Humming Birds from Peru, by John Gould, F.R.S.; Meteorological Observations and Table .... 314—320

NUMBER LXXXIX

XXVIII. On the Structure of Chlorophyll. By Hugo von Mohl. 321

XXIX. Notice on the question of the presence of an Operculum in the genus *Diplommatina*, Benson, and description of a New Species. By W. H. Benson, Esq. 329

XXX. Short Characters of some new Genera and Species of Algæ

Page

discovered on the coast of the Colony of Victoria, Australia. By W. H. HARVEY, M.D., M.R.I.A. &c., Keeper of the Herbarium of the University of Dublin. (With a Plate.) ... 332

XXXI. Some Remarks on Vegetable Placentation. By JOHN CLELAND, Esq ... 336

XXXII. On the Attitudes and Figures of the Morse. By Dr. J. E. GRAY, F.R.S., V.P.Z.S. ... 339

XXXIII. Descriptions of Eight New Species of Birds from South America. By JOHN GOULD, Esq., F.R.S. ... 343

XXXIV. On the Impregnation and Germination of the Algæ. By Dr. PRINGSHEIM ... 346

New Books.—A History of the British Marine Testaceous Mollusca, distributed in their Natural Order, by William Clark.—The Ferns of Great Britain Illustrated by John E. Sowerby. The Descriptions, Synonyms, &c. by C. Johnson.—First Steps in Economic Botany, for the use of Students, by Thomas Croxen Archer.—The Entomologist's Annual for 1855, edited by H. T. Stainton ... 349—357

Proceedings of the Royal Society; Linnæan Society; Zoological Society; Botanical Society of Edinburgh ... 357—383

Origin of Wheat, Mr. Busk's Anomalous Shell, by Prof. J. S. Henslow; On the Fructification of the *Arachis hypogæa*, by Hugh M. Neisler; On the Structure of the Starch Granule, by Mr. Grundy; Description of a New Species of *Aulacorhamphus*, by John Gould, F.R.S.; Meteorological Observations and Table ... 383—392

NUMBER XC.

XXXV. Monograph on the British species of *Phalangiidæ* or Harvest-men. By R. H. MEADE, F.R.C.S. (With two Plates.) ... 393

XXXVI. On the Structure of Chlorophyll. By HUGO VON MOHL. 416

XXXVII. On *Perna quadrata*, Sow. By JOHN LYCETT, Esq. ... 427

XXXVIII. Notes on the Ornithology of Madeira. By EDWARD VERNON HARCOURT, Esq. ... 430

XXXIX. On the Characters which distinguish the Vegetation of a Country. By M. ALPHONSE DECANDOLLE ... 438

Page
Proceedings of the Zoological Society; Royal Society 150—460

On *Phœnicura Tithys*, by Dr Jordan; On the Transmission and Metamorphoses of the Intestinal Worms, by MM. Milne-Edwards and Valenciennes; Note on the *Trichomonas vaginalis* of Donné, by MM. Scanzoni and Kolliker; On a Lunar Vapour Bow, by Charles Clouston; Meteorological Observations and Table...461—467

Index 468

PLATES IN VOL. XV.

PLATE I. New species of Diatomaceæ.
II. Sertularia alata.
III. Campanularia integra.—Halia prætenuis.—Anomalous Oyster-Shell.
IV. V. VI. VII. Fossil Echinoderms from the Island of Malta.
VIII. Development of Actinophrys Sol.—New species of Leech.—New species of Algæ.
IX. New British Diatomaceæ.
X. XI. British Phalangidæ.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SECOND SERIES.]

" . . . per litora spargite muscum,
Naiades, et circum vitreos considite fontes
Pollice virgineo teneros hic carpite flores
Floribus et pictum, divæ, replete canistrum
At vos, o Nymphæ Craterides, ite sub undas,
Ite, recurvato variata corallia trunco
Vellite muscosis e rupibus, et mihi conchas
Ferte, Deæ pelagi, et pingui conchylia succo."
N. Parthenii Giannettasii Ecl. 1.

No. 85. JANUARY 1855.

I.—*Notes of an Excursion to the South of France and the Auvergne in search of* Diatomaceæ. By the Rev. William Smith, F.L.S., Professor of Natural History, Queen's College, Cork.

[With a Plate.]

A statement of the results of an excursion made in the course of last spring to the shores of the Gulf of Lyons and the volcanic district of the Auvergne, may have some interest, at a time when much attention is being given to the minute organisms that more especially formed the object of my researches.

I have always thought that the geographical distribution of species in the Diatomaceæ is far more general and uniform than that in the higher orders of vegetable forms, and this opinion has received ample confirmation from the examination of the products of the various localities explored during the above journey.

While the Phanerogamous flora of the South of France is so widely different from that of the British Isles, that the most superficial observer cannot fail to be struck with its novelty, the Diatomaceous growth of its streams and lakes, and of that portion of the Mediterranean Sea that washes its coasts, is almost identical with that of our more northern localities.

The following outline of my tour will show the extent of my explorations, and I subjoin lists of the species that rewarded my search.

I reached Avignon on the 13th May 1854, and devoted several days to an examination of the interesting localities in its immediate neighbourhood, making gatherings of Diatomaceæ from a well in the Amphitheatre at Orange, from the river Sorgues at Vaucluse, and from the banks of the Rhone near the spot where it is joined by the waters of the Durance. Proceeding to Marseilles, I spent three days on the neighbouring shores of the Mediterranean, and collected from various spots north and south of the city, many specimens of the larger Algæ rich in parasitic Diatoms. A fountain in the court of the Hotel des Colonies, and a spring near Château Vert also supplied abundant materials for future examination.

Returning from Marseilles, I made collections near St. Chamas, on the borders of the Etang de Berre, a large salt-water lagoon connected with the Mediterranean, and on the same day explored the Canal de Crapone, in the vicinity of Arles.

On the 24th May, I reached Montpellier, and found a few specimens in the Château d'Eau, and the ponds of the Botanic Garden, but was more amply rewarded during excursions which I made from Montpellier to Frontignan, Cette and Agde, which again brought me to marine and brackish-water habitats, under the influence of the Mediterranean. The Canal du Midi and the river Hérault also supplied a few valuable gatherings.

From Montpellier my route lay through Nismes, where one gathering, from the celebrated Fountain of the Nymphs, proved rich in the number and variety of its forms.

From Nismes I passed to Alais, and thence across the Cevennes to the romantic city of Le Puy, collecting a few specimens at Genolhac and Langogne, at an elevation of about 4000 feet. The vicinity of Le Puy proved unproductive; not so the neighbourhood of Clermont-Ferrand, where I entered upon the volcanic region of Central France.

Collections made from the "Fontaine Pétrifiante," or calcareous spring of St. Alyre, and from basaltic caverns near the beautiful village of Royat, lying at the base of the Puy de Dôme, contained many interesting species.

Three weeks spent at the romantic watering-place of Mont Dore les Bains, at an elevation of 3424 feet above the level of the sea, enabled me to add to my herbarium most of the forms which characterize the mountain springs and marshes of this lofty region of extinct volcanos. The snows of the Pic de Sancy, at an elevation of 6100 feet, snow marshes on the Pic du Capuchin, and the shores of Lake Guery, a sheet of water which occupies the hollow of an ancient crater, proved fertile in a variety of forms. The eddies of the Dor, the mountain torrent which drains the district, and the perpendicular surface of the rock over which the stream is hurried that forms the Grande Cascade, were also productive.

From the Auvergne I proceeded to Orleans, and from the source of the Loiret, three miles from that city, collected excellent specimens of two rare and interesting forms, namely *Orthosira arenaria*, W. Sm, and *Gomphonema cristatum*, Ralfs.

The 4th of July closed my herborizations, and on that day I plundered one of the fountains of the Champs Elysées in Paris of materials, which added a few names to my roll of French Diatomaceæ.

The gatherings made during the above journey amounted to forty-nine, and the included species may be conveniently divided into five classes.

1st. Those which were found in the Gulf of Lyons.

2nd. Brackish-water forms in localities under the influence of the Mediterranean.

3rd. Species which were collected in springs and rivers at a low elevation.

4th. Forms which only occurred at high elevations in the volcanic districts of the Puy de Dôme and Mont Dore.

5th. Species or varieties which have not hitherto been figured or described.

In the following lists I have underlined those species which have not hitherto been found in Britain, and I employ throughout the nomenclature adopted in the "Synopsis," whether in the portion already published or in that prepared for the press.

List 1. *Mediterranean forms.*

Epithemia Musculus, *Kutz*
Cocconeis Scutellum, *Ehr*
—— diaphana, *W. Sm*
Eupodiscus fulvus, *W. Sm.*
Tryblionella Soleæformis, *W. Sm.*
Surirella fastuosa, *Ehr.*
—— striatula, *Turp* .
Amphiprora alata, *Kutz.*
Navicula didyma, *Kutz.*
—— Westii, *W. Sm.*
—— Pandura, *Bréb.*
Stauroneis pulchella, *W. Sm*
Pleurosigma elongatum, *W. Sm*
—— angulatum, *W. Sm.*
Synedra affinis, *Kütz.*
—— fulgens, *W. Sm.*
Podosphenia Ehrenbergii, *Kutz.*
Podosphenia Lyngbyei, *Kutz.*
—— elegans, *W. Sm*
Rhipidophora elongata, *Kutz*
Licmophora splendens, *Grev.*
Fragilaria striatula, *Lyng*
Striatella unipunctata, *Ag*
Hyalosira delicatula, Kutz
Rhabdonema arcuatum, *Kutz.*
—— Adriaticum, *Kutz.*
Grammatophora marina, *Kutz.*
—— serpentina, *Kutz.*
Biddulphia pulchella, *Gray.*
Achnanthes longipes, *Ag.*
—— subsessilis, *Kütz.*
Podosira hormoides, *Kütz.*
Berkeleya fragilis, *Grev.*

2. *Brackish-water species.*

Epithemia constricta, *Bréb*
Tryblionella gracilis, *W. Sm.*
—— punctata, *W. Sm.*
—— marginata, *W. Sm.*
Navicula tumens, *W. Sm*

Navicula Amphisbæna β, *W. Sm*
Pinnularia peregrina, *Ehr*
Nitzschia dubia, *W. Sm.*
Mastogloia Danseii, *Thw.*
—— lanceolata, *Thw.*

3. *Species collected at* low elevations, *many of which also occurred in the higher districts of the next class.*

Epithemia turgida, *W. Sm*
—— alpestris, *W. Sm*
Cymbella Helvetica, *Kutz.*
—— affinis, *Kutz*
—— maculata, *Kutz*
—— ventricosa, *Kütz.*
Amphora ovalis, *Kutz*
Cocconeis Pediculus, *Ehr*
—— Placentula, *Ehr*
Cyclotella operculata, *Kutz*
Campylodiscus costatus, *W. Sm*
Surirella angusta, *Kutz.*
—— ovata, *Kutz*
—— ovalis, *Bréb*
—— turgida, *W. Sm*
Cymatopleura Solea, *W. Sm*
—— Hibernica, *W. Sm*
—— elliptica, *W. Sm.*
Nitzschia minutissima, *W. Sm*
—— sigmoidea, *W. Sm*
—— linearis, *W. Sm.*
—— Amphioxys, *W. Sm*
Navicula ambigua, *Ehr.*
—— ovalis, *W. Sm.*
—— dicephala, *Kütz.*
—— tumida, *W. Sm*
—— Amphirhynchus, *Ehr.*
Pinnularia radiosa, *W. Sm*
—— acuta, *W. Sm.*
—— viridis, *W. Sm*
—— Stauroneiformis, *W. Sm*
Stauroneiformis β, *W. Sm*
Stauroneis Phœnicenteron, *Ehr.*
—— gracilis, *Ehr.*
—— anceps, *Ehr.*

Stauroneis? rectangularis, *Greg*
Pleurosigma attenuatum, *W. Sm*
Synedra radians, *W. Sm*
—— Ulna, *Ehr*
—— pulchella, *Kutz*
—— (*Nitzschia*) *Palea*, Kutz
Cocconema lanceolatum, *Ehr*
—— Cistula, *Ehr*
—— cymbiforme, *Ehr*
Gomphonema capitatum, *Ehr.*
—— constrictum, *Ehr.*
—— acuminatum, *Ehr*
—— dichotomum, *Kutz*
—— olivaceum, *Ehr.*
—— curvatum, *Kutz.*
—— cristatum, *Ralfs.*
Meridion circulare, *Ag*
—— circulare, var β, *W. Sm*
—— constrictum, *Ralfs*
—— constrictum, var β, *W. Sm*
Fragilaria capucina, *Desm.*
Odontidium mesodon, *Kutz.*
—— Tabellaria, *W. Sm.*
Diatoma vulgare, *Kutz.*
Denticula tenuis, *Kutz.*
—— inflata, *W. Sm.*
—— sinuata, *W. Sm.*
Achnanthidium lanceolatum, *Bréb*
Achnanthes exilis, *Kutz*
Melosira varians, *Ag*
Orthosira arenaria, *W. Sm.*
Mastogloia Smithii, *Thw*
Encyonema prostratum, *Ralfs*
—— cæspitosum, *Kutz.*

4. *Species collected at* high elevations *in the* Auvergne.

Epithemia rupestris, *W. Sm.*
Eunotia Arcus, *W. Sm.*
—— gracilis, *W. Sm.*
—— tetraodon, *Ehr*
—— tridentula, *Ehr.*
—— quaternaria, *Ehr.*
—— *quinaria*, Ehr

Cymbella cuspidata, *Kütz.*
Cocconeis Thwaitesii, *W. Sm.*
Surirella biseriata, *Bréb.*
—— splendida, *Kütz.*
—— linearis, *W. Sm.*
Navicula rhomboides, *Ehr.*
—— rhynchocephala, *Kütz.*

Navicula crassinervia, *Bréb*
—— **serians**, *Kutz.*
—— **firma**, *Kutz.*
—— **gibberula**, *Kutz*
Stauroneis dilatata, *W. Sm.*
Pinnularia nobilis, *Ehr.*
—— **major**, *W. Sm*
—— **acuminata**, *W. Sm*
—— **gibba**, *Ehr*
—— **divergens**, *W. Sm*
—— **late striata**, *Greg*
—— **hemiptera**, *Bréb*
—— **nodosa**, *W. Sm*
—— **tenuis**, *Greg*

Synedra lunaris, *Ehr*
—— **biceps**, *W. Sm*
Himantidium Arcus, *Ehr.*
—— **gracile**, *Ehr*
—— **pectinale**, *Kutz*
Fragilaria virescens, *Ralfs*
Odontidium hyemale, *Kutz*
Tabellaria flocculosa, *W. Sm*
—— **fenestrata**, *Kutz*
Melosira distans, *Kutz*
—— **nivalis**, *W. Sm*
Orthosira orichalcea, *W. Sm*
Colletonema vulgare, *W. Sm.*

5. *Species or varieties* not hitherto figured *or described.*

Navicula firma, var β, *W. Sm*
Gomphonema capitatum, var β, *W. Sm*
—— capitatum, var γ, *W. Sm*
—— Brébissonii, *Kutz*
—— elongatum, *W. Sm.*
Diatoma vulgare, var. β, *W. Sm*
—— grande, *W. Sm*

Fragilaria undulata, *W. Sm*
Odontidium anomalum, *W. Sm*
Achnanthidium lineare, *W. Sm.*
—— coarctatum, *Bréb*
Amphitetras antediluviana, var β, *W. Sm*
Orthosira spinosa, *W. Sm*

I subjoin a description of the species and varieties included in the last list.

Navicula firma, var. β, W. Sm. Synopsis of Brit. Diatomaceæ, p. 48.

Fresh water. Pic du Capucin, Mt Dore, elevation 4565 feet.

This is probably the normal *Nav firma*, Kutz. Bacill. xvi. 10, and I am disposed to refer *Nav amphigomphus*, Kütz. Bacill. xxviii. 40, to the same species.

PLATE I. fig. 1. Valves of *Nav firma β.*

Gomphonema capitatum, W. Sm. Syn. Brit. Diat. p. 80. pl. 28. 237.

Var. β. Upper portion of frustule almost linear, elongated, equal to, or slightly exceeding the lower. Length of frustule ·0013″ to ·0023″. v.v.

Var. γ. Much attenuated towards both the extremities. Length ·0012″ to ·0016″. v.v.

Var. γ. G. Fusticulus, W. Sm. MSS Greg. in Mic. Journ. vol. iii. p. 39.

Fresh water. Var. β. Puy du Cliergue, elevation 5576 feet. Ilford near Lewes, Nov. 1853, *W. Sm.* River Spey, July 1854, *Dr. Gregory.* Braemar, Aug. 1854, *Dr. Balfour.* Var. γ. Spring at Château Vert near Marseilles. Braemar, Aug. 1854, *Dr. Balfour.*

PLATE I. fig. 2 β. *Gomphonema capitatum,* var. β. Fig. 2 γ. *G. capitatum,* var. γ.

Gomphonema Brébissonii, Kutz. Valve constricted above the centre, upper extremity cuneate, obtuse, lower gradually attenuated and acute. Striæ 24 in ·001″. Length ·0013″ to ·0018″. v.v.

Kütz. in Sp. Alg. p. 66. ad specim. authen. quæ dedit am. De Brébisson.

Fresh water. Puy du Chergue.

But slightly differing from *G. acuminatum,* var γ, W. Sm. Syn. Brit Diat. pl. 28 238. *a‴*; and probably only another variety of the same species

PLATE I fig 3 *Gomphonema Brébissonii*

Gomphonema elongatum, W. Sm. Valves inflated at centre, afterwards constricted towards both extremities, the upper of which is capitate, or somewhat cuneate, the lower slightly inflated below the constriction, afterwards attenuated and obtuse. Striæ 24 in ·001″. Length ·0018″ to ·0045″. v.v.

Gomphonema Brébissonii, Greg. in Mic. Journ vol. ii p 99. pl. 4. 18.

Fresh water. Puy du Cliergue, *W. Sm.* Mull Deposit, *Dr. Gregory.* Wisbeach, April 1854, *Mr. G. Smith.*

This may probably be a variety of *G. Brébissonii,* Kütz , with which it occurs intermixed in the French gathering; both are in my opinion closely allied to *G. acuminatum.*

PLATE I. fig. 4 *Gomphonema elongatum.*

Diatoma vulgare, Bory.

Var. β. Valve linear, extremities gradually and slightly attenuated. Length of frustule ·0018″ to ·0030″. v.v.

Diatoma tenue, Ag., ad specim. in herb. Grev.

Fresh water. Fountain in court of the Hotel des Colonies, Marseilles, Canal du Midi, and Canal de Crapone; Plumpton, Sussex, April 1852, *W. Sm.* Pentland Hills, April 1821, *Dr. Greville.*

The valve in the normal form of *D. vulgare* is elliptical and suddenly attenuated towards the extremities.

PLATE I fig. 5. *Diatoma vulgare,* var. β.

Diatoma grande, W. Sm. Valve linear, constricted near the capitate and rounded extremities. Costæ 24 in ·001″.

Length of frustule ·0017″ to ·0038″. Breadth of valve ·00025″ to ·0003″. v.v.

Fresh water River Sorgues near Vaucluse; River Lune, Lancashire, April 1848, *Mr. G. Smith.* River Shannon near Athlone, and Lough Corrib river, July 1853, *W. Sm.* Lough Neagh, *Dr. Dickie.* Lough Leven, May 1851, *Dr. Gregory.*

A very fine and distinct species allied to *D. Ehrenbergii*, Kütz. Bacill. xvii. 17, but distinguished by the linear outline of its valve, its closer striæ, and greater relative size.

PLATE I. fig 6. *Diatoma grande*

Fragilaria undata, W. Sm. Filaments imperfectly tenacious; frustules frequently cohering by their angles; valve oval or linear, acuminate. Striæ 12 in ·001″. Length of frustule ·0006″ to ·0008″.

Var β. Valve linear, acuminate. Length of frustule ·0008″ to ·0012″. v v.

Var γ. Valve constricted in the centre. Length of frustule ·0008″ to ·0021″. v.v.

Var. γ *Odontidium Tabellaria*, "sporangia," Greg Mic Journ. vol. ii. pl 4. 22.

Fresh water. River Mortes, Lac Guery, Mont Dore, elevation 4066 feet. Var. γ. Mull Deposit, &c

The specimens which I collected in the locality above mentioned enabled me to assign the present species to the genus *Fragilaria.* Its mode of growth and delicately striated valves ally it closely with *F. virescens.*

PLATE I fig. 7. *Fragilaria undata.*

Odontidium anomalum, W. Sm. Filament tenacious; valves linear, constricted towards the obtuse extremities. Costæ 4 to 12. Length of frustule ·0005″ to ·0012″. v.v.

Var. β. Frustules with internal cells.

Fresh water. Genolhac in the Cevennes, elevation about 4000 ft. Braemar, Perthshire, Aug 1854, *Dr. Balfour.*

The presence of internal cells within the ordinary frustule, a mode of growth occasional in others of the Diatomaceæ, is frequent in this species, and frustules of the more usual description are rarely to be detected in the above gatherings; they may however be found at times, side by side with others, containing internal cells, showing that the latter formation is a modification of the usual method, and not a normal condition of the filament.

PLATE I. fig 8 *Odontidium anomalum*

Achnanthidium lineare, W. Sm. Valve linear, obtuse; striæ obscure. Length ·0003″ to ·0007″. v.v.

Fresh water. Fountain of Vaucluse, Lasswade near Edinburgh, June 1854, *Dr. Greville.*

Plate I fig. 9 *Achnanthidium lineare*

Achnanthidium coarctatum, Bréb. Valve linear-elliptical, constricted at the centre, attenuate, and constricted towards the rounded extremities Striæ moniliform, 24 in ·001″. Length of frustule ·0013″ to ·0018″. v.v.

Bréb. in Kutz. Sp. Alg. p 51 ad specim authen. quæ dedit am De Brébisson.

Fresh water Cave near Royat, Grassmere, Westmoreland, Aug. 1853, *W Sm*

Plate I fig 10 *Achnanthidium coarctatum*

Amphitetras antediluviana, Ehr

Var. β. Frustules cruciform, angles produced, valves with a deep sinus between each angle.

Marine. Salt Pans near Agde, *W. Sm* Stomach of Crab, *Professor Williamson*, 1852. Near Ipswich, Aug 1852, *Mr. Hodgson* Poole Bay, Nov. 1849, *W. Sm.* Near Cumbrae, Feb. 1851, *Mr R. Hennedy.*

I had at first distributed the present variety as a distinct species, and proposed to name it *A. excavata,* but the structure of the valve is exactly that of the ordinary form; and although the produced angles and consequently concave valve, as well as the deeply hollowed sides, give a very peculiar physiognomy to the frustules, I am constrained to regard it as a variety of Ehrenberg's well-known species.

Plate I fig. 11. *Amphitetras antediluviana,* var β.

Orthosira spinosa, W. Sm. Filament fragile, often only partially cohering; valves cylindrical, spinose at the line of junction, striated; striæ moniliform, radiate, 30 in ·001″. Breadth of filament ·0005″ to ·0017″. v.v.

Fresh water. Cave near Royat. Cave under Grand Cascade, Mont Dore; elevation 4236 feet. Braemar, Aug. 1854, *Dr. Balfour.*

Plate I. fig 12. *Orthosira spinosa*: *a*, filament drawn from a balsam mounting; and *b*, ditto from a dried specimen.

It will be seen by the above lists, that only three of the species collected during my late journey are to be regarded as foreign to our own waters, and it is not improbable that of these, *Eunotia quinaria*, Ehr., and *Nitzschia Palea*, Kutz., will be found to be natives of Britain. There only remains *Hyalosira delicatula*, Kutz., and as Professor Kützing gives the Atlantic as a locality for this species, it may also prove to be indigenous.

This result demonstrates the general distribution of these organisms, and the discovery by Professor Balfour of several of the rarer forms of the Auvergne, among the lofty ridges of the Grampians, is also an interesting circumstance, showing that elevation, and consequently temperature, influence the character of the minute Diatomaceous vegetation, as well as that of the larger and more conspicuous flora of such regions.

Lewes, Nov. 29th, 1854.

EXPLANATION OF PLATE I.

Fig. 1. Side views of two valves of *Navicula firma*, var. β.
Fig. 2. *Gomphonema capitatum*, var. β and γ.
Fig. 3. *Gomphonema Brebissonii.*
Fig. 4. *Gomphonema elongatum.*
Fig. 5. *Diatoma vulgare*, var. β.
Fig. 6. *Diatoma grande.*
Fig. 7. Filament and valves of *Fragilaria undata.*
Fig. 8. Filament and valves of *Odontidium anomalum.*
Fig. 9. *Achnanthidium lineare.*
Fig. 10. *Achnanthidium coarctatum.*
Fig. 11. Front and side view of *Amphitetras antediluviana*, var. β.
Fig. 12. *Orthosira spinosa*: *a.* Front view from a balsam mounting; *b.* Front view from a dry specimen; *c* and *c′*. Side views of frustules.

II.—*Amended Characters of the singular Lymneadous Genus* Camptoceras, *and description of a new* Ancylus, *inhabitants of North-western India.* By W. H. Benson, Esq.

In 1842, M'Clelland's 'Calcutta Journal of Natural History' contained the description of a new Lymneadous genus, which appears not to have attracted in Europe the attention which it deserves, principally in consequence of the scarcity of the publication in the pages of which it is to be found, although some pains were taken to make it more generally known by forwarding to Mr. Hugh Cuming, and to the British Museum, from India, copies of the paper and specimens of the shell. The form appears of sufficient importance to warrant the publication of revised and more extended characters of the genus, together with a few observations on its habits, and the locality in which it occurs, points shortly adverted to in the former notice.

Genus *Camptoceras*, Benson.

(Character emendatus et auctus.)

Testa sinistrorsa, imperforata, elongato-elliptica, spira soluta, apice acutiusculo, sutura late et profunde excavata (re vera omnino carente); anfractibus 3–4 angustis elongatis, superne et subtus carinatis, lateribus planulatis; apicali elongato-acuminato, longe exserto; ultimo antice superne descendente, carinato, apertura soluta, integra, magna, spiram non æquante, elongato-elliptica, angustiuscula, superne et ad basin arcuatim angulata, peristomate acuto; operculo nullo.

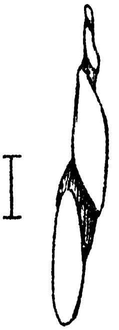
Species unica.

C. Terebra, Benson.

Testa elongato-elliptica, hyalina, vel albido-cornea, lineis spiralibus, exiguis, vix elevatis, striis obliquis confertissime decussatis, apertura verticali, elliptica; peristomate acuto, vix expansiusculo.

Long. vix 9, plerumque 6 ad 7 mill.

Diam. 3 mill. Long. apert. exempl. majoris 4 mill.



C Terebra.

Syn. *C. Terebra*, Benson, Calcutta Journ. Nat. Hist. 1842.

Hab. in lacu paludoso prope Moradabad, agro Rohillano.

Animal.

Animal tentaculis duobus filiformibus, obtusis, oculis magnis inter tentacula sitis, proboscideque mediocri munitum; pallio labia testæ haud transeunte, pede brevi, longitudinem aperturæ vix superante.

The form of the tentacula and the position of the eyes, situated between the filiform tentacula, and sessile on the head (not, as in *Lymnæa*, occupying the fore part of the widened base of the triangular tentacula), at once distinguish the animal from that of *Lymnæa*. In *Camptoceras* the eyes are large in proportion to the size of the animal, while in *Lymnæa* they present only a minute black point, even in individuals of large size. In *Ancylus* also the eyes are small, and inserted in two lateral lobes proceeding from the tentacular laminæ, which are triangular and truncated*. The shortness of the foot, however, the sluggish movements of the mollusk, and its strong adhesion to smooth surfaces, point to an affinity with *Ancylus*, which, instead of presenting the elongate, imperfectly rolled, acutely spiral cone

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* Vide Dupuy, Mollusques de France

of *Camptoceras*, sinks into a widely-spread, depressed cone, with scarcely any distortion of the spire.

The animal adheres, in deep water, to the decaying stems of a reedy sedge, more frequently burrowing into them, and concealing itself between the internal layers; a habit which renders it difficult to detect.

When my lamented friend Dr. Bacon found the first specimens in my presence, the idea which immediately presented itself was that the shell was a monstrosity; however, an examination of the animal, its peculiar habits, the absence of any known shell, in the whole of India, of which it could possibly be a distorted variety, and the persistence of character in some sixty specimens, secured at various times, all concurred to dispel such a supposition.

The shell was very local, occurring in one piece of water only, of several which had evidently once formed a portion of the bed of the Ram Gunga River. Singularly enough, *Planorbis Calathus*, which we had only met with in the mountains, distant 100 miles, and at an altitude of 4000 feet, was likewise detected in, and found to be nearly restricted to, this water. In a neighbouring pond, similarly circumstanced, *Planorbis carnosus*, nobis, was exclusively obtained; and to a third lagoon, in the immediate vicinity, was confined the shallow *Ancylus Verruca*, nobis, which I had discovered in the mountains accompanying *Planorbis Calathus*, but which proved to be also abundant in the weedy channel of the Rajhéra, distant a few miles from Moradabad. It appeared as if the original habitat of *Camptoceras* had been the scarcely explored woody mountains which give birth to the Ram Gunga, and that in a former course of the river through the broad alluvial bed in which it now wanders, these unwonted forms had been capriciously distributed in the deep hollows which had become disconnected by the retirement of the stream.

The short periodic appearance, on high grounds, near the ponds in question, of the rare *Planorbis Rotula*, nobis, Annals, vol. v. 1850, page 351 (since figured by Dunker), illustrates the uncertain appearance of some species of freshwater shells; and of this *Camptoceras* also affords an example. After the first captures, towards the end of February 1842, specimens were with difficulty procurable. In March 1843 I could not find more than three individuals, and Dr. Bacon was altogether unsuccessful. A like want of success attended a cursory effort which we made at the end of 1845. It would appear as if our researches had exhausted the supplies of the shell, which had taken possession of the water plants, within reach from the banks of the lagoon, and no means were at hand for exploring those which were farther from the shore. Possibly the animal may have been a favourite morsel of the wild ducks which haunted the place in the cold season. It may have been more abundant in the rainy season, during July and August, but the character of the surrounding ground was not then favourable, in point of healthiness or practicability, for exploration. The extermination of an abundant but local water plant, *Anacharis Alsinastrum*, from a Scottish lake, under the relentless bill of the common Swan, serves to show how the presence of a peculiar foe may influence the propagation of certain species, whether vegetable or animal.

It is worthy of remark, that no recent species of *Physa* has hitherto been met with on the continent of India. On the other hand, it seems to be the head-quarters of *Lymnæa*, many species of which (occasionally of gigantic dimensions) swarm in every stagnant pool throughout the country, accompanied by *Planorbis Coromandelicus*, Fabr. (*Indicus*, nobis), and other species of minute types, while *Ancylus* has only been detected in a few waters in the lower ranges of the Western Himalaya, and in the plains at their feet. The other freshwater univalves, contained in the same water with *Camptoceras*, were a large *Ampullaria*, two large species of *Lymnæa*, four species of *Planorbis*, *Melania tuberculata*, and some small *Bithiniæ*. Although deficient on the continent of India, the genus *Physa* appears in Ceylon, where Mr. E. Layard procured two large species; one of which is ovate and solid, the other much lengthened and acuminate, being 32 mill. in length by 14 mill. in breadth. It exhibits no symptom of an approach to *Camptoceras* in its mode of convolution, nor in the form of the aperture, of which the columellar lip is strongly twisted.

Not having yet published the species of *Ancylus* above adverted to, its characters are now appended.

Ancylus Verruca, nobis.

Testa vix sinistrorsa, depressa, subelongato-ovata, postice vix angustiori, lævigata, pallide virente-flavida vel cinerea, tenui, intus albida, submargaritacea, antice superne convexiuscula, postice prope umbonem breviter declivi, umbone vix elevato, compressiusculo, submediano, ad spatium $\frac{2}{5}$ totæ testæ posita.

Long $3\frac{1}{2}$, diam. vix 2 mill., alt. 1 mill.

Hab. ad lacum Bhimtâl Kemaonensem, in palude prope Moradabad, in rivo Rajhéra, necnon in rivo Sote, sive Yar Wuffadar dicto, prope Budaon Rohillarum, semper foliis plantarum aquaticarum natantibus adhærens.

Spa, Belgium, November 30th, 1854.

Having preserved living specimens of *Ancylus Verruca*, in a large glass vase of water, among floating water plants, upwards of a month, I ascertained that these usually sluggish mollusks occasionally swam, at an early hour of the day, resupinate at the surface. I am not aware that this habit has been remarked in the genus in question by any other observer.

I find the following description of the animal of an unpublished *Physa*, which I took, in 1816, at Michelville, between Cape Town and Hottentot Holland:—

Foot narrow, hinder extremity pointed, not extending beyond the summit of the spire. Head with veliform lobes or expansions in front. Tentacula subulate, lengthened, and somewhat spread all round at the base, the eyes being situated on these prominences, between the tentacula. Mantle reflected so as to cover merely the edge of the aperture all round, exposing the whole of the breathing cavity, at the hinder part of which, near the junction of the outer lip of the shell with the body-whorl, appears a tongue-like process.

8th December 1854.

III.—*Characters of the Genus* Opisthoporus, *an Eastern form of the* Cyclostomacea, *with Remarks on its Affinities and Notes on several Opercula.* By W. H. Benson, Esq.

On my passage through Zurich, last summer, Professor Mousson kindly afforded me an opportunity of comparing a shell transmitted to me by Dr. Traill from Borneo* (identical with *Cyclostoma* (*Pterocyclos*) *Charbonnieri*, Recl., and *Cyclotus Taylorianus*, Pfr.), with the imperfect specimen of *Pterocyclos biciliatus*, Mouss., figured in the 'Mollusken von Java.' We found that they were in nowise to be distinguished from each other. I have long dissented from the received location of this, and allied species, in *Cyclotus* and *Pterocyclos*, with reference not only, in the case of the former, to the springing of a retroverted tube from the suture, but also to the formation of the operculum, which, externally, has some resemblance to the vertebra of a fish; or, as remarked by Recluz, is formed like a pulley, the broad edge of the disk being grooved or excavated in the direction of its circumference.

On a closer examination it will be found that this apparently solid operculum is formed by two layers, an inner and an outer one, the former having a horny coating: these two layers are united by an erect, internal, spiral lamina, the spaces between which are hollow and hermetically closed; and the concavity of the outermost lamina, or whorl, causes the singular pulley-like appearance of the edge.

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* Vide 'Annals' for 1853, vol. xi. N.S. p. 32 and 33.

The abnormal construction of this operculum fully entitles the form to distinction on the same grounds as those on which the other genera of the *Cyclostomacea* rest I do not hesitate, therefore, to separate it, under the designation some time since proposed in my correspondence with Dr. L. Pfeiffer, on a view of the species brought home by Lieut W Taylor, which subsequently appear to have passed into the hands of Mr Cuming; carefully guarding it from the intrusion of other tubuliferous shells, belonging to *Alycæus* and *Pterocyclos*, which Albers has proposed to associate with it in a paper published in the 'Zeitschrift fur Malakozoologie' for 1852. Dr. Pfeiffer opposed that view, and, while objecting to the separation of *O. Taylorianus* from *Cyclotus*, showed that Albers' scheme would unite shells belonging to several distinct types under the name which I had restricted to a portion. The peculiar structure of the operculum, to which those of *Aulopoma* and *Pomatias* only exhibit a faint resemblance in their hollow construction, has hitherto escaped observation.

Genus *Opisthoporus*, nobis.

Operculum calcareum, circulare, crassiusculum, multispiratum, duplex, utrinque concaviusculum, disco interno, epidermide cornea lubrica vestito, externo calcareo, scabro, duobus lamina spirali, erecta recurva interposita, junctis; anfractuum interstitiis interne vacuum præbentibus; margine circumdante concavo

Testa depressa, orbicularis, late umbilicata, sutura pone aperturam tubulo exserto, pervio, munita. Peristoma duplex, externum expansum, superne antice subfornicato-alatum, internum superne interdum emarginatum breviterque incisum.

Sp. 1. *Opisthoporus biciliatus*, Mousson.
SYN. *Pterocyclos biciliatus*, Mouss. Java Moll. p. 49. tab. 20. f. 9 (1849).
Cyclotus Taylorianus, Pfr. 1851, Zeitschr. p. 7.
Cyclostoma (*Pterocyclos*) *Charbonnieri*, Recl. Journ. Conch. 1851, vol ii. p. 214. t. 5. f. 12, 13.

Sp. 2. *Opisthoporus rostellatus*, Pfr.
SYN. *Cyclotus* (*Cyclostoma*), Pfr. Zeitschr. 1851, p. 8, and Mon. p. 40.

Sp. 3. *Opisthoporus spiracellum*, Ad. and Reeve.
SYN. *Cyclostoma spiracellum*, ditto, Voy. Samarang, p. 56. t. 14. f. 1.

Sp. 4. *Opisthoporus tubuliferus*, Pfr.
SYN. *Cyclotus tubuliferus*, ditto, Mal. Blätt. vol. i. p. 31.

The circumstance of the tube in the suture of the last-quoted species being directed forwards will not render any change necessary in the name, the tube being still posterior with reference to the aperture. The description of the mouth, tube, and operculum of *O. spiracellum*, brought by the Samarang from an island off the N E point of Borneo, permits no doubt of its place being in the proposed genus. Pfeiffer has placed it, with a mark of doubt, in *Pterocyclos*, while he surmises that it may be the same species as the Singapore *rostellatus*. The inflated back, and strangulation of the last whorl militate against this conclusion The genus occupies a range from Singapore, through Borneo, towards the Manilla group.

The place which *Opisthoporus* holds will be found, as fixed for the type by Pfeiffer, between *Cyclotus*, to which it is linked by the abnormal species *C. variegatus*, Swainson, and *Pterocyclos*, the aberrant form, *Pt. hispidus*, Pearson, forming the passage to the typical species of the latter genus, and agreeing with *Opisthoporus* in the aperture and sutural tube; while it holds to *Pterocyclos* by the operculum. Not having *C. variegatus* at hand for comparison, I cannot say if the internal structure and edge of the thickened operculum resemble that of *Opisthoporus*, but, in the absence of the spiral elevated lamina at the edge of the turns, it decidedly gives warning of a departure from the received Cyclotoid type If it should be found eventually to exhibit the structure of the operculum of *O biciliatus*, inasmuch as the suture is destitute of a tube, the name which I have imposed will be held inapplicable to all the species, and, in that case, it may be desirable to use one of more general application, when the term *Cœlopoma**, nobis, may be substituted.

It may here be remarked that, on the strength of the tectiform canaliculate wing, Pfeiffer has admitted *Cyclostoma breve*, Martyn, and *C. planorbulum*, Lamk. (genus *Myxostoma*, Trosch.) into *Pterocyclos*, from which the difference of substance and the plane laminar structure of the multispiral opercula appear wholly to exclude them. Now as *C. planorbulum* of the 'Encyclopédie Méthodique' was clearly the typical species of *Cyclotus*, Guilding, as made known by Swainson, it may be ultimately advisable to separate this shell from *Pterocyclos* under Guilding's name, and to restore Troschel's name *Aperostoma* to the shells bearing the form of operculum which Troschel had especially in view in proposing that division. After *C. planorbulum*, Swainson quoted *C. variegatum* as an additional species of the type; and it will depend upon the internal structure of its operculum, whether, as is most probable, it should be associated with *planor-*

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* *Cœlopoma*—κοῖλος, cavus, and πῶμα, operculum.

bulum as a true *Cyclotus*, Guild., or with *Taylorianus*, &c. as an *Opisthoporus* or a *Cœlopoma*.

In respect to *Pterocyclos* (*Lituus*) *brevis*, Martyn, I am disposed to associate it with *Cyclophorus* rather than with *Pterocyclos*. The wing is not truly Pterocycliform, and is rather an exaggerated representation of the angle and sulcus observed in *C. Nilagiricus* and other *Cyclophori*, while the thickened, horny, multispiral, and slightly concave operculum is closely related to the same form. The internal face of the operculum has not been yet described. It is smooth, the margin encircled with a thickened, slightly elevated band, and the centre is occupied by a broad convexity, with a more prominent central reddish translucent boss,—a feature observable in *C. Perdix* and its allies. The thimble-shaped operculum of *Pterocyclos*, horny or cartilaginous, with a calcareous skeleton or foundation, perforated in the centre when denuded of its outer coating, can scarcely be said to have any affinity with it.

Of another shell, *Pt. incomptus*, Sow., classed by Pfeiffer with *Pterocyclos*, I can say little. Its operculum is not known. The prediction may however be ventured, that, when examined, it will be found that the form will have no *locus standi* in *Pterocyclos*. The wing here indicates an analogy, not an affinity to the genus, and it may be expected that its operculum will be so constituted as to associate it with such species as *Cyclotus giganteus* and *Inca*.

As every notice regarding the unrecorded opercula of the *Cyclostomacea* tends to establish our knowledge of the family, the following descriptions, in addition to those given in a recent paper, will not be without their use.

Cyclotus semistriatus, Sow.

Operculo calcareo, arcte 6-spirato, nucleo planato; margine anfractuum 4–5 exteriorum acute elevato, subreflexo, interstitiis concavis profundis, scabre oblique plicatis.

From specimens taken alive at Kirkee in the Deccan.

Cyclotus filocinctus, Bens.

Operculo extus concavo; anfractibus paucis, margine scabre elevato.

Cyclophorus cuspidatus, Bens.

Operculo tenui concavo, corneo, arctissime spirato; margine anfractuum lineari.

Cyclophorus Indicus, Desh.

Operculo crassiusculo, obscure rubello-corneo, 6-spirato, extus scabro, margine anfractuum elevatiusculo, lineari, intus lubrico, umbone centrali exiguo munito.

From specimens which reached London alive, from the Concan, near Bombay.

Cyclostoma marginatum, Chemn.

Under this name Pfeiffer cites *Turbo marginatus*, Ch., from Coromandel, in his list of doubtful species Mon. p 313, with the observation that it may rather be a *Bithinia*. The latter supposition is correct. I have this shell, clearly indicated by Chemnitz, sent by Dr. Jerdon from the Carnatic, and by Mr. Edgar Layard from Jaffna in Northern Ceylon. It is the shell which Souleyet (Voy. de la Bonite, vol ii. p 517. t. 31. f. 19–21) has described and figured as *Valvata sulcata*, from a pond near Pondichery, although he has omitted to describe the delicate striæ by which the spiral ridges are decussated. Souleyet has erred in ascribing the shell to *Valvata*. The testaceous operculum confirms its place in *Bithinia*. Souleyet says it is "vix spiraliter striatum;" his engraver exhibits an operculum with concentric striæ. The truth evidently lies between, and, as in other *Bithiniæ*, there must be a central spiral nucleus, followed by concentric laminæ. Unfortunately my specimens are destitute of opercula. The shell will henceforth stand as *Bithinia* (*Turbo*) *marginata*, Ch.

Spa, 24th November 1854

IV.—*On Artificial Sea Water*. By Philip H. Gosse, A.L.S.

To the Editors of the Annals of Natural History.

GENTLEMEN,

If Mr. Warington supposes that I obtained from him one atom of information previously unknown to me, on the subject of making sea-water from its constituent salts, he is most thoroughly mistaken. He is no less wrong in saying that I "consulted" him; since I merely mentioned what was on my mind in familiar conversation.

With this, however, the public are of course not concerned, and I shall say no more on that head.

Such of your readers as have felt interested in the matter may be assured that I have not deceived them, in the statement that the simple formula given in the 'Annals' for July 1854 will make sea-water, in every respect fit for an aquarium, and capable of supporting animal and vegetable life.

A glance at my paper will show that I gave Dr. Schweitzer's analysis exactly as now given by Mr. Warington; but, as I wrote for practical people, to whom minute accuracy is impossible, and to whom a chemical formula expressed in quantities of four or five decimals would certainly act as a prohibition, I reduced it to a simpler form; having first made the experiment, whether such a departure from exact accuracy would vitiate the composition.

Now surely here is the point If I had merely theorized;—if I had given it *as my opinion* and nothing more, that the simplified formula would answer, I should be justly blameable; but *I proved my hypothesis before I published it.*

That Mr. Warington's calculations are correct I do not at all deny; but that they convict mine of "error" I by no means admit; as my facts will presently show. The "error" (which is of that kind technically called "*nidus equæ*") lies altogether on the other side.

The half-gallon of artificial sea-water which was the result of my first experiment, and formed the subject of my communication to your pages, still exists. From the 21st of April to the present date it has never been even shifted from the vessel into which it was first put, nor have its constituents been changed in any respect.

Now mark the result. A large number of little healthy plants of *Ulva* and of *Conferva* have sprung up and grown in it, which on every sunny day give forth a copious supply of oxygen. Some of the original animals yet remain, in a healthful condition, as *Actiniæ* and *Serpulæ*; though others have died off in the course of the summer, and have been replaced by more. A whole generation of *Bowerbankiæ* appeared in August, quite unexpectedly, spreading in ramose shrubs about the glass sides, and after a while died away. At present there are in the vessel, besides those above-mentioned, a Prawn, and several Periwinkles. The water has always maintained, up to this day, a perfect clearness. Is not this case conclusive?

But I have further evidence. On the 23rd of August last I manufactured nine gallons of sea-water, using the very same proportions of salts as before;—with which I half-filled a square glass tank. I stocked it immediately with plants, and in about a week with animals. This experiment also has been perfectly successful. The animals remain in high health to the present time, as do also many more which were added to the stock in the early part of November. Here too the water continues perfectly transparent and colourless.

The stock of this tank includes at present the following animals:—

Crustacea.

1 Carcinus mœnas
1 Porcellana platycheles.
1 Palæmon serratus
1 Crangon vulgaris

Mollusca.

4 Littorina littoralis
1 Purpura lapillus.
1 Murex erinaceus.
1 Chiton (lævis?)
1 Doris tuberculata.
1 Pleurobranchus plumula
1 Mytilus edulis
1 Ascidia —— ?

Annelida.

1 Borlasia?

Zoophyta.

5 Actinia mesembryanthemum
4 —— bellis
1 —— gemmacea
3 —— troglodytes
2 —— clavata
1 Actinia nivea.
3 —— rosea.
1 —— venusta
1 Anthea cereus
1 Balanophyllia regia

I leave these facts to speak for themselves. They are better than a thousand theories. Here is one vessel of water made from my formula eight months ago; here is another made four months ago. Neither has at any time been changed, nor even shifted; the waste of evaporation has been merely supplied from time to time with fresh (*i. e.* river) water. Both of them have always maintained marine animals and vegetables in health, from the first until now, and both contain animals that have survived for the whole period. Finally, both have preserved their purity and transparency.

I shall be but too happy to show any scientific persons the vessels in question, and to give any information in my power.

I am, Gentlemen, your obedient servant,

P. H. Gosse.

58, Huntingdon Street, Barnsbury Park,
December 20th, 1854

P.S. Some letters which have been lately published by Mr. W. A. Lloyd in the 'Athenæum' confirm my experience. Perhaps I may be excused for citing a few words contained in a private letter from the same gentleman to myself —

"In reference to what has recently been published on an improvement (or a *supposed* improvement) on your receipt for the manufacture of sea water, a friend of mine took me by the button and said, 'My dear Sir, Mr. Gosse is altogether wrong; he has not salt enough; he has no ——.' To which I replied, pointing to two fine *Actinia dianthus* in full blow in one of my vessels,— 'But if Mr. Gosse is altogether wrong, why do these *Actiniæ* flourish?' This was unanswerable."

V.—*Notes on Swiss Mollusca.*
By J. Gwyn Jeffreys, Esq., F.R.S.

Having spent the last summer and autumn with my family at Lausanne, on the Lake of Geneva, during which period I collected with some assiduity the land and freshwater shells in that district, and also made occasional excursions, with the same object, to the adjoining Cantons of the Valais and Geneva (thus embracing in my circuit the highest Alps and lowest valleys in Switzerland), I am induced to think that a notice of some hitherto unrecorded localities which thus occurred to me may be interesting to those who have studied this branch of natural history; and more especially if considered with regard to the geographical distribution of animals, a subject which has of late years much engrossed the attention of naturalists.

In making this communication, I must, in the first place, acknowledge the great obligation I feel to my kind and hospitable friend, M. de Charpentier of Devens, near Bex, who not only gave me free and frequent access to his fine collection of land and freshwater shells, but furnished me with many valuable notes (of which I will here, with his permission, avail myself) by way of supplement to his "Catalogue des Mollusques Terrestres et Fluviatiles de la Suisse," which forms part of the Transactions of the Helvetic Society, published at Neufchâtel in 1837. No one can appreciate more highly than myself the discrimination and accuracy of this celebrated *savant*, as well as his disinclination to increase the already too numerous list of so-called species. I had also the pleasure of forming an agreeable, but transient, acquaintance with the Abbé Stabile, who published at Lugano in 1845 a Catalogue of the Land and Freshwater Shells of that district. With these two exceptions, I am not aware that Switzerland now possesses any native conchologist; although the country has been for a period of between thirty and forty years indefatigably explored by Studer, Monnard, Venetz, Mousson, Thomas, Charpentier, and others in search of Mollusca.

The immediate vicinity of Lausanne, where I was located, consists of an irregular and comparatively low range of hills called the Jorat (the highest of which, Le Pélerin, is 2148 feet above the lake, and 3300 feet above the sea-level), and belongs to a geological formation termed "Molasse" (a soft and friable sandstone of the carboniferous series), and it presents very few characteristic forms of Mollusca. Indeed if it were not for the different scenery and mode of cultivating the land, a conchologist might almost fancy himself to be in one of the midland counties of England. The southern flanks of the Jura also yielded many species which are common on our own mountain limestone. But the difference of form is chiefly perceptible on the Alps and in the Alpine valleys, where the sister kingdoms of Botany and Entomology also hold their courts and delight the naturalist. Some species are only found on the confines of Italy, although in a subalpine zone, and appear to depend on latitude rather than on climate or temperature. One species (*Helix sylvatica*) is found as well on the plains of the Rhone Valley, as (though dwarfed in size) at a height of many thousand feet above the level of the sea. The shores of Lake Leman offered the lowest elevation above that level, being, according to Keller's map, 1150 feet; and the highest point at which I found living Mollusca was the Ryfel, about 8000 feet (near Monte Rosa, in the Haut Valais), where *Vitrina diaphana*, var. (*V. glacialis* of Forbes) occurs in ground which is almost constantly frozen. How far specific variation may be influenced by climate, temperature, or latitude, is a difficult problem, which requires for its solution far more materials and data than we as yet possess.

I will now plunge *in medias res*, adopting Charpentier's Catalogue as my text-book.

Vitrina diaphana, Draparnaud.

Rochers Naye and Dent de Jaman, Mont Tendre, on the Jura; Zermatt, Le Salève, near Geneva. Not uncommon.

Var. α. Spira utrinque compressa. Animal nigro-fuscum.

Vitrina glacialis, Forbes "On Alpine Testacea," in Magazine of Zoology and Botany, vol. i.

Le Ryfel, near Monte Rosa, in the Haut Valais, at an elevation of about 8000 feet above the sea.

My late lamented friend, Professor Edward Forbes, considered this to be a distinct species, because of the darker colour of the animal; but the gradations of colour and form from this variety to the next through the typical species, are almost imperceptible.

Var. β. Spira superne prominula. *Vitrina nivalis*, Charp.

Alps near Bex (Charp.);—Valley of St. Nicholas. Rare

Vitrina pellucida, Müller.

Rochers Naye; Chable, Belmont and Les Pierrettes, near Lausanne, Devens Common.

Vitrina annularis, (Venetz), Férussac. *V. subglobosa*, Michaud and Morelet.

Devens; Sion, Foully (Charp.),—Valley of St. Nicholas, St. Maurice; Chable in the Vallée de Bagnes. Rare.

This species has also been lately taken by Mr. Mac Andrew at Burgos in Spain, at an elevation of between 2000 and 3000 feet above the level of the sea.

Vitrina elongata, Drap.

Valley of St. Nicholas, at an elevation of about 4000 feet. **Rare.**

This species had not been found before in Switzerland, and was supposed to be confined to the champaign parts of France and Germany.

Succinea Pfeifferi, Rossmässler.

Clarens; Martigny (Charp.);—Lac de Bret; Belmont, and other places near Lausanne, Villeneuve; Vallée de Bagnes; Visp; Lacs de Joux et Brenet. Rather common.

At first considered by Charpentier to be a variety of *Succinea putris.*

Succinea oblonga, Drap.

Valley of the Rhone (Charp.). With the last: not uncommon.

A variety of a larger size and greenish colour occurred to me in Belmont Wood, near Lausanne.

Helix Pomatia, Linnæus.

I found a depauperated variety, of the usual size, on the Dent de Jaman, at the height of about 5000 feet.

Helix aspersa, Müll.

It is remarkable that our common garden snail, which is so widely dispersed, from the Shetland Isles to Algiers, is not indigenous to Switzerland or any part of Germany. It is said that the extreme severity of the cold in winter prevents its inhabiting the latter countries.

Helix sylvatica, Drap.

This local species did not occur to me in the Jura, or westward of Vevay, although it is common in the Alps, and plains to the east.

Helix zonata, Studer.

Valleys of Entremont, St. Nicholas, and St. Bernard; Simplon; Tessin; Airolo (Charp.). I also found it at Zermatt, Randa, and St. Nicholas, in the last-named valley.

Helix personata, Drap.

Bex; Kandersteig, and Valley of the Lac de Joux (Charp.);—Chailly, and Belmont, near Lausanne; Mont Tendre; Rochers Naye, Chable; also at Meillierie in Savoy. Not uncommon.

Helix holosericea, Studer.

Vallées de Morcles et d'Entremont (Charp.) ;—wood between St. Nicholas and Randa. Not uncommon.

Helix angigyra, Ziegler.

Lugano (Charp.).

Helix lapicida, Linn.

Var. Albida.

Valley of the Drause.

Helix Nautiliformis (*Drepanostoma*), Porro.

Lugano; Magadino (Charp.)

Helix unidentata, Drap.

Le bas Engadine (Charp.).

Helix edentula, Drap.

Monthez (Charp.) ;—Mont de la Dame, and Mont Tendre, in the Vallée de Joux ; Rochers Naye and Dent de Jaman ; Chable. Local, but gregarious.

Helix fulva, Müll.

Generally diffused, and common.

A variety of a dark horn-colour occurred in marshy places, and a white variety (but rare) near the Findel Glacier, in the Haut Valais.

Helix aculeata, Drap.

Sion, and other parts of the Valais (Charp.);—Belmont and Sauvebelin Woods, near Lausanne, and many other places.

Helix ciliata, (Venetz), Fér.

M. Charpentier was misinformed as to this elegant species having been found in England, whence he states that he received it.

Helix sericea, Drap.

The transition, by connecting links, from this to its polymorphous ally, *Helix hispida,* makes its specific distinctness very doubtful.

Helix cœlata, Stud.

Neighbourhood of Lausanne; shores of the Lac du Brenet; St Nicholas; Chable. Common.

Helix rufescens, Montagu (var.).

Helix circinata and *montana,* Stud.

Var. Albida.

Mont Tendre.

Helix (*Trichia*) *clandestina,* Hartmann.

Zurich; Lucerne; Schwyz (Charp.).

Helix strigella, Drap.

Foully, Sion; Tourbillon, and other parts of the Valais (Charp.);—Clermont, and on the side of the Geneva road near Lausanne; St Nicholas; Chable.

Helix fruticum, Drap.

Saléve, near Geneva.

Helix Carthusianella, Drap.

Near Aigle (Charp.), and found by myself at Devens.

Helix incarnata, Drap.

Belmont and Sauvebelin Woods, near Lausanne; Dent de Jaman; Pré de Joux; Vufflens. Common.

Helix candidula, Stud.

Le Saléve, near Geneva.

The *Helix Cenisia* of Charpentier is the *H. apicina* of Lamarck.

Helix rotundata, Müll.

Var. Albida.

Belmont and Berne road, near Lausanne.

Helix ruderata, Stud.

Vallée d'Ormonts (Charp.);—Valley of St. Nicholas and Zermatt, where I also found a greenish-white variety. Not uncommon.

Helix rupestris, Drap.

Var. (?) *H. umbilicata,* Mont.

On rocks and under stones in many places, and at different heights varying from 1200 to 5000 feet above the sea-level. Common.

This species was accidentally omitted by M. Charpentier in his Catalogue. I am not satisfied that the *H. umbilicata* of Montagu is not specifically distinct. This and the typical form are found together on the limestone rocks near St. Maurice.

Helix pygmæa, Drap.

This has an equally extensive range with the last species, and is equally common.

Helix glabra, Fér.

Sion; Martigny; Coire (Charp.); Belmont, near Lausanne; Zermatt.

M. Schmidt, in an elaborate memoir on the genus *Zonites*, and especially on the *Z. alliaria* of Miller (published in the 'Malakozoologische Blatter' for this year), considers these to be distinct species. The *H. alliaria* has been found by M. Grateloup at Dax, in the department of the Landes.

Helix cellaria, Müll.

Devens and other places (Charp.); neighbourhood of Lausanne. Not uncommon.

The *Helix nitens* of Michaud, which M. Charpentier referred to the *H. cellaria* of Studer, is a different species, and allied to *H. nitidula*. It was introduced by him in error as Swiss.

Helix nitidula, Drap.

Var. Albida. *H. Helmii*, Gilbertson.

Belmont Wood, near Lausanne.

Helix petronella, (Charp.), Pfeiff. Helic.

Helix vitrina, Fér.

Enzeindaz, in the Grisons (Charp.);—Mont Tendre; Findel, in the Haut Valais. Rare.

An interesting species, allied to *H. radiatula* of British authors.

Helix radiatula, Alder.

Helix pura, var. β, Pfeiff. Helic.

Chamblande and Sauvebelin Wood, near Lausanne; Vufflens; Villeneuve, Terrain and Devens, in the Valley of the Rhone; Visp; St. Nicholas. Not uncommon.

It has also been found, according to M. Terver, near Lyons, and in the Department de l'Oise.

Helix lucida, Drap.

Lac de Bret; Chamblande and other places near Lausanne; Vallée de Bagnes. Common.

Helix pura, Alder.
Helix nitidula, var. β, Drap.
Helix nitidosa, Fér.

Belmont and Sauvebelin Woods, near Lausanne; Mont la Ville Not uncommon.

Var. Albida. *Helix viridula* of Menke's Synopsis.

Chable, in the Vallée de Bagnes.

Bulimus radiatus, Drap., and varieties.

About half a league west of Lausanne, on the Geneva road. Common.

Bulimus obscurus, Mull.

Neighbourhood of Lausanne, Blonay; Chable, Salève, and the Jura. Common.

Var. Albida.

Devens.

Bulimus montanus, Drap.

Belmont Wood, and Berne road near Lausanne.

Pupa tridens, Mull.

Near the rifle-shooting gallery, Lausanne; and rejectamenta of a stream at Chamblande. Local, but gregarious.

Pupa quadridens, Müll.

Neighbourhood of Lausanne; Vevay; Sierre; Zermatt, and other places. Common.

Var. Minor et albida.

Chable.

The last two species are now (and, as I consider, properly) placed among the *Bulimi.*

Pupa edentula, Drap.

Zurich; Clarens (Charp.);—in a marshy piece of ground near Belmont. Not uncommon.

Pupa inornata, Mich.

Winteregg, near the Pass of the Gemmi, by Mr. Shuttleworth (Charp.);—on wet moss and grass in a wood above Zermatt. Not uncommon.

I am not, however, satisfied that it is specifically distinct from *P. edentula.*

Pupa muscorum, Drap. (*Pupa cylindrica*, Fér. et al.)

Bex; Tourbillon (Charp.);—Clermont, near Lausanne; Devens; Les Vallettes, in the Valley of the Dranse; St. Nicholas. Not uncommon.

Var. unidentata (*P. unidentata*, Stud.).
Var. tridentata.

Between Bex and St. Maurice.

The last is a remarkable variety, the arrangement of the teeth being the same as in *P. tridentata.*

Pupa Ferrarii, Porro.

Lugano (Charp.).

Pupa pagodula, Desmoulins.

Lugano (Charp.).

Pupa doliolum, Drap.

In a copse near Lausanne, between Bex and St. Maurice. Not uncommon.

Pupa umbilicata, Drap.

Antagne; limestone rocks near a small chapel dedicated to Notre Dame du Sex, St. Maurice (Charp.).

In the last-named locality it is common, as well as a white variety.

Pupa dilucida, Ziegler.

Gondo; Lugano (Charp.).

Closely allied to the last species and to *P. Sempronii.*

Pupa marginata, Drap.

Neighbourhood of Lausanne and Valley of the Dranse. Not uncommon.

Pupa Halleriana, Charp. MS.

I give M. Charpentier's description, which I carefully went over with him:—

> "Testa breviter rimata, oblongo-cylindrica, apice obtusa, striatula, sub lente minutissime granulata, nitidula, rufescenti-cornea; anfractus 7, convexiusculi, regulariter accrescentes, ultimus basi in cristam brevem, obtusam, extus scrobiculo notatam, compressus, pone aperturam semi-ovalem, edentulam, callo angusto, concolore, nec albido circumdatus; peristoma reflexiusculum, callo margines jungente penitus destitutum. Alt. 3–3½; diam. 2–2¼ mill.

"Prata paludosa prope Tedunum, Saxon, Octodurum, Roche (haud procul a domo ipso Halleri magni); Mousson, Venetz, Charpentier.

"A *Pupa Cupa*, Jan, Kust, t. 16, f. 16, 17, quacum olim confudi et ex errore sub eo nomine ad amicos misi, satis differt: testa minutissime granulata, nec simpliciter striatula; anfractu ultimo obtuso breviterque basi compresso; apertura constanter edentula (in plus quam 100 speciminibus) nec plica parietali instructa, semiovali, nec rotundato-trigona, nec marginibus callo junctis.

"A *Pupa marginata* var. *edentula* facile distinguitur: statura paullim majore, testa magis contracta, callo pone aperturam angustiore, concolore, nec albido et scrobiculo ad cristæ cerviculis basin. Hæc species locos siccos, *P. Halleriana* autem paludosos habitat."

I also found this new and interesting species under stones and at the roots of grass in wet meadows, at Visp, as well as at Chable and another place in the Vallée de Bagnes; so that its elevation may be said to range from about 1250 to double that number of feet above the sea-level. It is not uncommon, although local.

Pupa Alpicola, Charp.

St. Maurice (Charp.); Mont Tendre; Les Vallettes in the Valley of the Dranse. Not uncommon.

I am not satisfied that it is specifically distinct from *P. triplicata.*

Pupa triplicata, Studer.

Salève; Mont la Ville; Les Pierrettes, Devens; Bex; Vallée de Bagnes; Sierre; Visp; Zermatt. Not uncommon. I also found it near Dijon in France.

Monst. testa sinistrorsa.

Rejectamenta of a small stream into the lake below Lausanne, in which I found a single specimen. It shows the close affinity of form between *Pupa* and *Vertigo.*

Pupa dolium, Drap.

Neighbourhood of Lausanne; Mont la Ville; Lac du Brenet.

Pupa granum, Drap.

St. Leonard; Mont d'Orge (Charp.).

Pupa secale, Drap.

The *Pupa hordeum* of Studer, and quoted by M. Charpentier, is only a variety of the above species. The typical form is universally dispersed, and not confined to the Jura and the Alps.

Pupa variabilis, Drap.

Sion; Foully (Charp.);—Belmont Wood, near Lausanne, but not common there. It is however plentiful at Antagne, near Bex.

Pupa pygmæa, Drap.

Belmont, Savigny road, and Les Pierrettes, near Lausanne; Vufflens; Mont Tendre; Villeneuve; Chable; Visp. Common.

Pupa Shuttleworthiana, Charp.

Bex; Ollon; Soleure (Charp.);—Zermatt; Les Vallettes. Rare.

Pupa antivertigo, Drap.

Belmont and Les Pierrettes; Villeneuve; Chable; Visp. Not uncommon.

Pupa Desmoulinsiana, Dupuy.

P. (Vertigo) Charpentieri, Pfeiff. Helic.

Clarens, Payerne (Charp.).—At the roots of rushes and grass, Visp; and in a marsh about half a league west of Lausanne. Not uncommon.

The animal is dark gray, with its foot or sustentaculum of a paler colour. Tentacula 2 only, rather thick, short, clavate, diverging, and obtuse at their extremities. The body is more slender and of a lighter colour than that of *P. antivertigo* (*septemdentata*), and the tentacula are more decidedly clavate. It feeds on confervæ.

Pupa vertigo, Drap.

Devens (Charp.),—between Bex and St. Maurice; Vallée de Bagnes. Not common.

Pupa Venetzii (Charp.)

Vertigo angustior, mihi, in Linn Trans. (1828).

Sion (Charp.);—Les Pierrettes, near Lausanne, Villeneuve; Chable. Not uncommon.

Balea perversa, Linn.

Bex (Charp.); Belmont and other places near Lausanne; Les Vallettes; Zermatt. Gregarious, but local.

Clausilia bidens, Drap.

Var. Albida.

Belmont Wood, near Lausanne; Devens.

Clausilia diodon, Stud.

M. Charpentier says that the locality of the Vallée de Bagnes, which he indicated on the authority of M. Venetz, is erroneous, and that it ought to have been Gondo, on the Simplon. He adds, that he found a single, but fresh, specimen among the rejectamenta of the Rhone, near Bex.

Clausilia ventricosa, Drap.
Vallée d'Ormonts; Payerne (Charp.);—Belmont and other places near Lausanne; Rochers Nez; Devens.

Clausilia similis, Charp.
Turbo biplicatus, Mont.

M. Charpentier doubts this species having been ever found in Switzerland, and he thinks *C. plicata* may have been mistaken for it.

Clausilia dubia, Drap., is now generally considered to be synonymous with *C. rugosa.* This variety or form appears to be very common and widely spread in Switzerland.

Clausilia cruciata, Stud., is admitted by M. Charpentier to be another variety of the same species.

Clausilia obtusa, Pfeiff., which M. Charpentier found at Freiburg, is another variety.

Clausilia plicata, Drap.
Zurich; Guevaux; Schwyz (Charp.).

Clausilia Moussonii, Charp.
Zurich (Mousson and Charp.).

Clausilia ornata, Ziegl.
Winteregg (Shuttleworth).

Clausilia Stabilei, Charp.
Clausilia tumida, Stab.
Lugano (Stabile).

Achatina acicula, Müll.
Chamblande, near Lausanne; St. Maurice.

Cionella lubrica, Müll.
Var. Minor seu alpina.
Chable; Zermatt.

Physa hypnorum, Drap.
Foully, and Valley of the Rhone (Charp.); Les Pierrettes, near Lausanne; and also in several parts of the Rhone Valley. Not uncommon.

Physa fontinalis, Drap.
Yverdun; Orbe (Charp.).

Limneus minutus, Drap.

Neighbourhood of Lausanne; Lac du Brenet; Vallée de Bagnes; Valley of the Rhone. Common, and widely dispersed.

Limneus auricularius, Drap.

Lac de Bret, Les Grangettes, and other marshes bordering on the Lake of Geneva.

The *L. acronicus* of Studer (*L. ampullaceus* of Rossmässler) is a well-marked variety or form of this protean species.

Limneus pereger, Drap.

Var. Limneus rimatus, Braun

Gryon, Chessières (Charp.).

Var. Limneus Blauneri, Shuttl.

Schwartzee, near Zmutt (Shuttl.).

This variety resembles the "*Gulnaria lacustris*" of Leach.

Var. Limneus vulgaris, Pfeiff.

Roche (Charp.).

Limneus elongatus, Drap.

Canton du Tessin (Stab.).

Planorbis contortus, Drap.

Lac du Morat, près de Sallavaux (Charp.);—neighbourhood of Lausanne; Lac du Brenet; marsh between Martigny and St. Maurice. Not uncommon.

Planorbis leucostoma, Mich.

Neighbourhood of Lausanne; Lac de Bret; Vufflens.

This common species is not, however, the *P. spirorbis* of Draparnaud, to which Studer and Charpentier have referred it.

Planorbis carinatus, Drap.

Lakes of Geneva and Brenet.

The variety described by M. Charpentier under the name of *P. intermedius*, is the *P. carinatus* of my Monograph in the 'Linnæan Transactions'; the typical or extreme form having been named by me *P. disciformis*.

Planorbis hispidus, Drap.

Noville; Valley of the Rhone (Charp.);—Les Pierrettes; Lac du Brenet. Not uncommon.

Planorbis subcarinatus, Charp.

Planorbis Draparnaldi, mihi, in Linn. Trans.

M. Charpentier states that the Swiss locality for this species is Delémont, instead of the Lake of Constance; and the latter for his *P. intermedius.*

Planorbis imbricatus, Drap.

Var. Planorbis cristatus of that author.

In a marsh about a league from Lausanne, on the Geneva road.

Planorbis complanatus, Drap.

Neighbourhood of Lausanne; Lac du Brenet, Valley of the Rhone. Not common.

Planorbis corneus, Mull.

Berne, from M. Schmidt (Charp.)

Ancylus lacustris, Drap.

Lac de Bret; Roche (Charp.). It is still rather plentiful at Chamblande, the first Swiss locality indicated by M. Charpentier.

Cyclostoma maculatum, Drap.

Saléve, near Geneva.

Var. Albida.

Mont Tendre

Acme fusca, Walker. *Auricula lineata,* Drap.

Lugano; Sion (Charp.); Belmont and elsewhere near Lausanne.

A variety, which is quite destitute of the longitudinally impressed lines, also occurred to me.

Valvata planorbis, Drap.

Lac du Morat (Charp.),—Les Pierrettes; Lac du Brenet; marsh between Martigny and St. Maurice.

Paludina abbreviata, Mich.

Prevon d'Avaux (Charp.).

Paludina marginata, Mich.

Carouge, near Geneva; Nyon (Charp.).

I will not pretend to meddle with the numerous so-called of *Anodontæ* and *Uniones;* although I am satisfied that may be all reduced to one or, at the most, two species of each genus.

Cyclas rivalis, Drap.

Lacs du Brenet et Bret, near Carouge, Geneva.

Var. Cyclas nucleus, Stud.

Chamblande, near Lausanne.

Var Cyclas lacustris, Charp. (but *query* of Draparnaud ?).

Les Pierrettes, near Lausanne.

Cyclas calyculata, Drap

Mont d'Orge (Charp.). In a pond on the Berne road, and at Les Pierrettes, near Lausanne, Visp.

The colour of specimens taken in the same place during the months of June and October differed considerably in intensity, being much darker in the latter month, when they perhaps put on their winter dress.

Var. Cyclas Ryckholtii, Normand (Cyclades de Valenciennes).

With the normal or typical form in the first locality indicated by me, but not common.

Pisidium obliquum, Drap.

Lac de Neufchâtel, près d'Yverdun (Charp.).

Pisidium fontinale, Pfeiff.

Pisidium pusillum, Jenyns, and var *Pisidium minimum*, Stud.

In every pond and ditch. Common

Pisidium cinereum, Ald.

In a small pond near Lausanne, on the Berne road, ditch near Le Pélerin; Visp. Local, but gregarious

Pisidium nitidum, Jen. (1832).

Pisidium roseum, Scholtz (1843).

Lacs de Bret et Brenet; Visp. Rare.

I have thus added to the list of Swiss Mollusca the undermentioned species. *Vitrina elongata*, *Succinea Pfeifferi*; *Helix angigyra*, *H. Nautiliformis*, *H. radiatula*, *H. pura*, *Pupa inornata*, *P. Ferrari*, *P. pagodula*, *P. dilucida*, *P. Halleriana*; *Clausilia Moussonii*, *C. ornata*, *C. Stabilei*; *Limneus elongatus*; *Planorbis corneus*; *Paludina abbreviata*, *Pal. marginata*; *Pisidium cinereum*, *Pisid. nitidum*; being altogether twenty. One species (*Pupa Halleriana*) has been now described for the first time.

The complete list shows the following result with regard to the British Mollusca.

Swiss, but not yet indicated as British.

Vitrina diaphana.
—— annularis.
—— elongata.
Helix sylvatica.
—— cingulata.
—— zonata.
—— personata.
—— holosericea
—— angigyra
—— Nautiliformis
—— unidentata
—— edentula.
—— ciliata
—— villosa.
—— cœlata.
—— clandestina.
—— strigella
—— fruticum.
—— incarnata.
—— candidula.
—— apicina.
—— ruderata
—— glabra ?
—— petronella.
—— diaphana, *Stud.* ?
Bulimus radiatus
Pupa tridens.
—— quadridens.
Pupa inornata?
—— Ferrari.
—— pagodula.
—— doliolum.
—— Sempronii.
—— dilucida.
—— Halleriana.
—— Alpicola ?
—— triplicata
—— dolium.
—— granum
—— avena.
—— frumentum
—— variabilis.
—— Shuttleworthiana
—— Desmoulinsiana
Clausilia diodon
—— ventricosa
—— plicata.
—— Moussonii.
—— ornata.
—— Stabilei
—— parvula.
Cyclostoma maculatum.
Valvata spirorbis.
Paludina abbreviata.
—— marginata.

Being in all fifty-five, inclusive of five doubtful species.

British, but not hitherto indicated as Swiss.

Testacella haliotoidea, *Drap.*
Vitrina Draparnaldi, *Jeffr* ?
Helix Cantiana, *Mont.*
—— Pisana, *Mull.*
—— virgata, *Da Costa*
—— caperata, *Mont.*
—— fusca, *Mont*
—— revelata, *Fér.*
—— globularis, *Jeffr.*
—— excavata, *Bean.*
—— lamellata, *Jeffr.*
Bulimus acutus, *Mont*
Pupa Anglica, *Fér.*
—— substriata, *Jeffr.*
Azeca tridens, *Pulteney*
Limneus glutinosus, *Müll.*
Limneus involutus, *Harvey*. If not a variety of last?
—— Burnetti, *Alder* If not a variety of L. pereger ?
Planorbis glaber, *Jeffr.*
—— lacustris, *Lightfoot*
Assiminea Grayana, *Leach.*
Bithinia Leachii, *Sheppard.*
—— anatina, *Drap.*
Neritina fluviatilis, *Linn.*
Dreissena polymorpha, *Pallas.*
Unio margaritiferus, *Linn.*
Cyclas rivicola, *Leach.*
Pisidium pulchellum, *Jen.*
—— Henslowianum, *Shepp*

Being in all twenty-eight, inclusive of three doubtful species.

The last list is taken from Forbes and Hanley's 'History of the British Mollusca,' being the latest and most accredited work on the subject. For the purpose of geographical distribution I include Ireland with Great Britain.

VI.—*Sketch of the Life of the late* Professor Edward Forbes. By J. H. Balfour, M.D., Professor of Botany, Edinburgh*.

While Europe is mourning over many a gallant officer whose life has been sacrificed for his country on the field of battle, the scientific world has been called upon to deplore the loss of one of its leaders who has fallen in the front ranks. Edward Forbes, Regius Professor of Natural History in Edinburgh, has been cut off in the zenith of his fame, and has left a blank which is not easily supplied Every department of science acknowledges its obligations to him, and his premature death has inflicted a heavy blow on the progress of Natural History. We have lost an original thinker, a careful observer, a correct reasoner, an able writer, a pleasing and painstaking instructor, and a valued friend. His sun is gone down ere it is yet day, and the extinction of such a luminary has cast a shade over the scientific horizon. Truly God's ways are not as our ways, nor his thoughts as our thoughts. Let us learn the lesson which the solemn event teaches, and so number our days as to apply our hearts to heavenly wisdom.

Edward Forbes (of Scottish extraction) was born in the Isle of Man, on the 12th day of February, 1815. His father was a banker in that island. Even in his early years he had a taste for natural history, and at the age of seven he had collected and arranged a small museum. When not more than twelve years old, Mr. James Wilson informs us, Forbes had imbibed a fondness for geological studies, and had perused such works as Buckland's 'Reliquiæ Diluvianæ,' Parkinson's 'Organic Remains,' and Conybeare's 'Geology of England.' He had also compiled a Manual of British Natural History in all its departments.

He visited London at the age of sixteen, and was engaged there in studying the art of drawing under Sass. His power of delineating with the pencil was called into constant exercise during his after career, and was displayed alike in his published works and in the illustration of his lectures. His early associates remember well the clever and amusing sketches which he made with the pen during moments of leisure.

He came to Edinburgh in 1831, and entered the medical classes, as being the course of study best fitted for initiating him to those departments of science to which he meant to devote himself. His earliest friend in Edinburgh was John Goodsir (now Professor of Anatomy), with whom he lived in the same lodgings for many years. They had congenial tastes, and prosecuted their studies together with an earnestness and enthusiasm rarely equalled. He attended nearly all the classes required for graduation, but he did not take the degree of M.D. He studied natural history and botany under Jameson and Graham, and became an intimate friend of both, more particularly of the latter, who by his zeal in the prosecution of practical botany inspired his pupils with an enthusiastic love of science.

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* Read before the Botanical Society, Thursday, Dec. 14, 1854.

In 1833, Forbes visited Norway with a fellow-student, and made considerable collections both geological and botanical. Many of the specimens of the plants are now in the Herbarium of the University of Edinburgh. They are by no means well preserved, but they are well selected, more especially as regards their bearing on botanical geography. For at this period of his history Forbes began to look with a comprehensive glance on the flora of Europe, and gave indication of those views of distribution which were afterwards developed fully in the Memoirs of the Geological Survey of Britain. An account of his observations in Norway were published in the Magazine of Natural History. On the 12th of May, 1836, I find a notice by Dr. Graham, in the Proceedings of the Botanical Society, of the flowering of a *Primula*, sent to the Garden by Forbes from Norway. Forbes sent it as a variety of *P. farinosa*, which he called *alpina*, while Graham considered it a variety of *P. Scotica.*

He became a member of the British Association in 1834, and afterwards was one of the most regular attenders of its meetings, contributing on all occasions valuable papers and reports. He it was who called the attention of the Association to the subject of dredging, and secured their cooperation and aid in this most important matter.

He appears to have visited the Alps in 1835; and in the Magazine of Zoology and Botany for 1837, he contributed a communication on the Comparative Elevation of the Testacea in the Alps.

His zeal for botany was at this time very great, and he saw the importance of not confining his attention to the flora of Britain. He therefore determined, along with his fellow-students in Edinburgh, to commence the formation of a public herbarium, by means of contributions and exchanges. This led to the establishment of the Botanical Society, an event which took place on Tuesday, the 9th of February, 1836. Well do I recollect the evening when he and I, with eight others, viz. W. H. Campbell, now LL.D. and attorney in Georgetown, Demerara; Dr. Parnell, afterwards author of the work on British Grasses, &c.; Dr. R. C. Alexander, who subsequently published accounts of botanical tours in many parts of Europe and America; William Brand, now Secretary of the Union Bank; Dr. Gilbert McNab, now practising in Jamaica;

James M^cNab, now Curator of the Botanic Garden; Nicholas Tyacke, now physician in Chichester; Edward Charlton, now M.D. and Lecturer in the Medical School of Newcastle; George C. Wallich, now in India; and Giles Munby, who wrote the 'Flora of Algiers,' met to lay the foundation of our Society. We received most important directions and aid from Forbes; and when, after launching the vessel, we supped together, his social and convivial powers were called forth in their fullest energy. His death constitutes the first blank in the little band. The first public meeting of the Society took place on the 17th of March, 1836, when the following office-bearers were appointed:—Prof. Graham, *President*; Dr Greville and Dr. Balfour, *Vice-Presidents*; Dr. Neill, Mr. Falconar, Dr. Barry, Mr. Munby and Mr. Tyacke, *Councillors*: W. H. Campbell, *Secretary*; Edward Forbes, *Foreign Secretary*, William Brand, *Treasurer*; and James M^cNab, *Curator of the Herbarium*. Forbes contributed many valuable communications and papers to the Society between the years 1836 and 1841.

On the 9th of June, 1836, Forbes gave a description of a species of *Viola*, found by him in the Isle of Man. He considered it the *V. ericetorum* of Schrader, *V. canina* of Reichenbach. On the 8th of December, 1836, a communication was transmitted by him, as to a supposed new British *Polygala*, found in the Isle of Man and on Dalmahoy Hill. He also brought under notice the various British forms of *Euphrasia*, some of which he was disposed to consider as distinct species. This view he continued to entertain; and when visiting the hills at the head of Loch Lomond in July 1854, he pointed out three of these forms to his pupils and mine.

On April 12, 1838, he read a paper to the Botanical Society, on the specific claims of *Primula acaulis*, *veris*, and *elatior*.

He continued during life to take a warm interest in the Botanical Society; and he resumed his place among us last summer, with no small feelings of satisfaction—with pleasant reminiscences of the past and brightest hopes of the future. He has sent contributions to the Herbarium of the Society from various parts of the world, and these are now incorporated with the University Herbarium.

He continued to prosecute his studies more or less continuously in Edinburgh till 1839. During that period he made himself beloved by all who came into contact with him. He inspired almost all his companions with zeal in science, and became as it were a centre whence emanated numerous active and enterprising naturalists.

In 1837, he prosecuted his studies in Paris under Prévost, Beudant, Geoffroy St. Hilaire, and De Blainville. In May of that year he went to Algiers; and in the Annals of Natural History for May 1839, he writes on the Land and Freshwater Mollusca of Algiers and Bougia. In 1838 appeared his '*Malacologia Monensis*, or Catalogue of the Mollusca of the Isle of Man and of the Irish Sea.' At this time also he wrote many papers on zoology and geology.

In the winter of that year his literary, artistic, and humorous powers were called into play in a publication named 'The Maga,' which became for a time a most popular work with students, more especially at the period subsequent to the snowball riots of the 11th and 12th of January of that year. He was one of those who took up the defence of the students on that occasion, acting as chairman of their committee, and he succeeded, with the aid of Patrick Roberton, now Lord Roberton (who is figured as their glorious defender), in carrying them through the trial in a most triumphant manner. This publication, with the poems which came from his pen at that time, as well as his sketches of men and manners, have left an indelible impression on all of us.

While all this was going on, he continued sedulously to pursue his natural-history studies. His usual working hours were from breakfast-time till 2 or 3 in the afternoon, after which he considered that he was entitled to a certain amount of relaxation from severer study. The same plan has been adopted by him ever since, when practicable · and one reason among others for his objecting to take an early hour for lectures was the encroachment which would thus have been made on the hours devoted to original observations.

In 1838 he visited Styria and Carniola, with the view of examining their natural history. His observations were recorded in the Proceedings of the Botanical Society. Thus on the 13th of November 1838 he read a paper on the *Primula elatior* of Jacquin, gathered by him during the summer of 1838 on the mountains of Styria; on the 13th of December 1838 he gave an account of three days' excursion to the mountains of Ternova in Carniola, made in company with Signor Tommasini of Trieste. On the 10th of January and 11th of April 1839 he read communications on certain continental plants allied to British species, the plants having been chiefly collected in Carniola and in the neighbourhood of Trieste.

In the summers of 1839–40 he delivered a scientific course of lectures on zoology, as well as one of a more popular nature, in which he pointed out the bearings of zoology on geology, a subject of which he was afterwards the most able expounder in Britain.

In 1839, at the Birmingham Meeting of the British Association, he and other naturalists finding that they had not their proper place at the convivial meetings, instituted a separate ordinary. The first Natural History Section dinner happened to take place in an inn of that town having the sign of the Red Lion; and ever afterwards the Natural History Club thus commenced was designated the Red Lion Club. The Red Lions have had their annual social reunions at every meeting of the Association since that time; and on these festive occasions, Forbes, who was perpetual president, had always a scientific song of a playful and humorous nature. Many of these songs were printed in the 'Literary Gazette.' It is interesting to notice, that among his papers was found an unfinished song, which he meant to have given at the Liverpool Meeting, and which contains a clever view of the geological dispute between Murchison and Sedgwick.

During this year he seems to have taken up in an especial manner the subject of fossil botany; and we find, on the 10th of May, that he proposed that the Botanical Society should print a Catalogue of the Fossil Plants of Britain. The Society entertained his proposal, and appointed him, along with his friends Torrie and Cunningham, to prepare the list.

He published this year 'Zoological Researches in Orkney and Shetland,' and zoological papers in connexion with Goodsir. In the 'Report of the Botanical Society's Proceedings' of the 12th of December 1839, and also on the 10th of December 1840, he is entered still as Foreign Secretary, as Member of the Wernerian Society, and as Lecturer on Natural History.

In 1840 he published in the 'Edinburgh Student's Annual,' a paper on the Distribution of the Mollusca of Britain, more especially with reference to the Pleistocene Geology.

In 1841 he published his beautiful Monograph on the British Star-Fishes, and other Echinoderms. The accurate drawings of the animals, and the exquisite tail-pieces and vignettes, were drawn by himself on wood, so as to be ready for the woodcutter. During my morning visits to him at this time, I found him always busy with his pencil.

On the 11th of March of this year he read to the Botanical Society a paper on the Specific Value of the Antherine Appendages of the genus *Viola*, in which he developed philosophical views in regard to what he calls the law of *undulation* of character in plants and animals. This law, he says, "has not been properly studied by naturalists, nor its value rightly appreciated; otherwise we should not have that common scientific phenomenon of imperfect descriptions presented as specific characters." The paper embraced not merely a description of the characters of the genus *Viola*, but an illustration of this law in the arrangement of the species, and their geographical distribution. It contains the germ of those views which he afterwards so fully enunciated, relative to types and representations.

In the spring of 1841 he accepted an invitation from Captain Graves, of the Beacon, to join the surveying party in the Mediterranean, in the capacity of naturalist. He and I met in London in April, along with Vogel, McWilliams, and Stanger, who were about to join the expedition to the Niger.

He was occupied until 1842 in examining the Ægean and the coasts of Asia Minor. During part of the time he visited Lycia and assisted Sir Charles Fellowes, along with Mr. Hoskyn, Mr. Daniell and Lieut. Spratt, in the exploration of some of the lost cities. His researches in the Ægean, in regard to marine life at different depths, led to those speculations which he afterwards promulgated relative to submarine life in connexion with geological changes. During this expedition his friend the Rev. E. T. Daniell died of fever brought on by malaria, and Forbes's life was also placed in imminent danger by a similar attack. He struggled through the fever, after lying for nearly a fortnight in a helpless state, without tasting food or receiving any medical advice This Ægean fever materially affected his constitution, and he had frequent aguish attacks afterwards, which he looked upon as referable to that illness.

During his researches at this time he looked with a naturalist's eye at everything, as is well shown in his 'Travels in Lycia,' which he afterwards (in 1846) published, in conjunction with Lieut. Spratt. Botany, zoology, geology, geography and antiquities were alike subjects of study and observation.

In July 1821 he wrote thus from Paros :—

"Paros, 21 July, 1841

"Dear Balfour,

* * * * * * * * * *

Here I am out of the world, working away like *bricks* (so to speak) in the midst of ruins. Hitherto my working has been almost entirely mineralogical and zoological, owing to delays on the part of the Oriental Steam Packet Company. Only three days ago did any of my parcels reach me, but they are now all here,—the box from the Botanical Society, a parcel of paper in oil-cloth from Dr. Graham, and a box from Sir William Jardine. I have dried a lot of plants in the paper which I got at Malta, but have hitherto regarded rather the collection of specimens to illustrate the flora of the Isles, than of duplicates, not having materials for the latter. Unfortunately the lateness of arrival of the box will prevent much being done in that way *here* this year, as the flora is almost gone, burnt up already, and there are no mountains sufficiently high for subalpine plants. Those of Naxos which I have ascended are 3500 feet high, but the vegetation of their summits is the same as that of their bases.

"I have just returned from a cruise among the islands, and I have been five weeks away in a little cutter with every convenience. The botanical result is, that the vegetation of all the islands I have seen is *exactly* similar

"I set off next week in another of our tenders on a six weeks' cruise, to visit the Volcanic isles and the south end of the Morea,—I hope with better botanical results. But as I said before, for botany one should be at work here in April. Next year I shall be better prepared for it. If one of the Commander's schemes, however, is put into execution, I expect yet to reap a rich harvest of plants this autumn. He proposes to send the 'Isabella,' one of our tenders, to the Gulf of Macri in Asia Minor to complete a survey. He will remain there six weeks, and I propose to go with him and ascend the snowy ridges of Taurus, which are within a few miles of Macri. As these mountains are from 5000 to 10,000 feet high, I may yet get a rich store of valuable plants from a country almost, if not wholly unexplored

"I hope yet we shall go to Candia in spring, which will be a great point for the botany. The zoological results, so far chiefly marine, have fully satisfied me, and I expect will prove most valuable. I am at work every day, and although I have a glorious set of companions, work very hard I wish there was some one with me to do the dredging and preserving, as it takes up much time As yet I have left birds alone I expected Thompson to have done them, but he is off home again, as I suppose you know already. Fishes, I let none of them escape me."

Another letter is dated—

"H M S Beacon, Macri, Asia Minor,
February 28, 1842.

"In my last letter I mentioned my intention of proceeding to Asia Minor in one of the Beacon's tenders in autumn Having done so in the early part of last October, it has been out of my power to write to you or any of my friends, as there is no communication between these shores and Europe. Still I expected to have written to the British dominions letters in abundance before the new year began, but circumstances most unexpected have sent the Beacon down here to join us, and prevented our joining it at Athens, as was intended.

"To give my itinerary in due order, my proceedings have been as follows:—Returning in October from a round of the islands of the Archipelago,—a cruise which was exceedingly fruitful in results as regarded marine zoology and tertiary geology, but in consequence of the season almost fruitless in botany,—I found the Beacon at Paros with half her crew laid up by the terrible fever which kills so many people here in summer, one of her best officers dead, and all in low spirits. The people under my charge,—for (you will laugh, I doubt not when I say so,) I have not only acted out here as naturalist, but when accompanying the tenders, as surgeon,—escaped altogether. In several cases here I really find my medical knowledge, small though it may be, of the greatest service. Indeed, at the present moment I am acting as physician in ordinary to the greatest personage in the country near us, namely, the Mohussil or Governor of Severo, 'a very great Turk with a very long name,' as the song goes.

Paros I set sail in our little schooner the *Isabella* to the shores of Asia Minor, and remained in her from October to the end of the year. I was thus able to make my promised excursion to the Taurus, ascending the mountains to the height of 9000 feet, and journeying among them for fourteen days. But though I loaded a mule with boards and paper, I grieve to say I could not fill it. Everything seemed to have gone out of flower to spite me, and what remained were odds and ends of plants past flowering.

"As this country, especially the alpine part (I speak of Lycia), has been visited by no botanist, I gathered every fragment most religiously, with a view to depositing the reliques (such as they are) in the Botanical Society, and they are now packed up and boxed in the charge of the captain of an English vessel which has unexpectedly come in here, and will be carried by him free of charge to some English port. I have directed them to Pamplin. Open and examine them when they come. Bad as they are, they have a geographical importance, and I do not take blame to myself for their badness.

"Next week the Beacon goes to Malta, if she had only stayed a month longer, I should have had lots of plants, now only beginning to flower. I remain behind with a view of rejoining her in Candia in May. I go up the country, but as it will be impossible during that journey to collect many specimens of everything, I shall confine myself to making a pretty perfect set of Lycian plants for the herbarium of the Botanical Society, Ward, Graham and yourself, which on consideration I think will be the best way of benefiting science in a country as yet unexplored, and better than laying by dubious stores. I enclose a table of the winter vegetation here to give you an idea of it. Lay it on the table at some meeting of the Society. I have not been fortunate hitherto in seeking after materia medica information, but hope to be so."

After having carried on his researches in the Ægean Sea, he had determined to proceed to Egypt and the Red Sea on a dredging excursion, when intelligence reached him that he had been chosen Professor of Botany in King's College, London, as successor to the late Professor Don. Application for this had been made by Goodsir and some other friends in his behalf, and his claims were at once recognized by the electors.

In 1842 he came to Britain with collections and drawings of scenery, of antiquities, of plants, of animals, and of men and manners, which in extent, variety, scientific value and artistic skill have never been equalled. A sum was voted by the Treasury for the publication of these, which Forbes intended to append to a treatise on the Natural History of Aristotle, a work for which he had collected ample materials. He commenced the preparation of 'Rambles of a Naturalist,' and in 1848 he writes, "my leisure now I give to my long advertised 'Rambles.' The cuts are done, but the middle of the book is yet unwritten."

His introductory lecture on botany was delivered in King's

College on May 8, 1843, and is a valuable one, full of original views and of potent arguments in favour of the educational value of Natural History. He now rose rapidly in favour. In 1843 he was appointed Curator and Assistant Secretary of the Geological Society of London, and became a Fellow of the Linnæan Society. At the meeting of the British Association at Cork this year he read a Report on the Mollusca and Radiata of the Ægean Sea; and as connected with his Ægean 'Travels,' he subsequently published remarks on the light thrown on geology by submarine researches. In October 1843 he writes thus:—

"Geological Museum, Somerset House.

"Dear Balfour,

"I have intended to write to you for a very long time, but intentions are not always deeds with me, in consequence of having a mass of work in hand,—mostly not my own,—which must be done, and which absorbs all my time. The fact is I have too much to do,—this geological post being a desperately fatiguing one, and leaving but little time for my more legitimate occupation at King's College My class last summer went off very well. I had a most excellent set of men, who behaved admirably and never flagged in attendance. I had three or four excursions of much interest, managed in our old fashion, alarming the neighbouring villages by an invasion of twenty or so *vasculiferi*. Shaw acted as my esquire and jester on all these occasions, and Lankester, with some other amateurs, also occasionally joined my ranks. My pupils were 48 in number, next to Lindley's, the best botanical class in London. If the 48 all paid the fees into my pocket 'more Scotico,' it would be very satisfactory, but the College absorbs more than a fourth of it, so that my receipts were much under the hundred, and as in one's first course there are many expenses, I get but little out of the total. As the College has a diagram painter, there was a saving on that score; for being obliged to be at the Geological all day long, I have no time to paint diagrams. The most provoking want is having no botanic garden, and I have no spare days to run after and make friends with gardeners, so that I have great difficulty in procuring fresh illustrations. Hooker offered me them from Kew, but on condition that I should go and select for myself personally, which is impossible as I am situated. We have a capital herbarium at the College, but when it is to be put into the state it should be I really cannot tell. It vexes me much thus to find myself unable to give sufficient time to any one thing.

"The Medical Professors at King's are a capital set of men, enthusiastic and talented. I have a fine room for a Museum, and should desire nothing better than time and fortune to do as I like there. I am now only beginning to touch my Eastern plants. When they are sorted they shall be distributed, but I cannot promise as to the time. My pupils in the Beacon are collecting with great success, and sent me a few days ago a beautiful little parcel from Mount Ida in Crete, including some things which may be new.

"I commend your intention of writing a text-book. What we want is a clear statement of the present state of vegetable physiology and anatomy, and a concise and *contrasting* view of the orders in a portable class volume. I speak now from having felt the want of such."

In the position of Geological Curator, "his extensive knowledge of recent vegetable and animal species, and his remarkable acquaintance with the laws of their distribution (particularly as regards invertebrate animals), became available for general palæontological research. Here, too, he was enabled to apply to geological research that peculiar knowledge of the conditions of existence of species, which his continual operations with the dredge had led him to. We owe to him the methodical use of the dredge as an instrument of research in natural history, to use his own words, 'the dredge is an instrument as valuable to a naturalist as a thermometer to a natural philosopher.' At his instance, the British Association has appointed for many years a dredging committee, charged with the duty of completing our knowledge of marine animals, with a view to geological inquiry."

In 1845 he became a Fellow of the Royal Society, and was afterwards a Member of Council. He was appointed Palæontologist to the Geological Survey of Great Britain, under Sir Henry De la Beche, and subsequently became Professor of Zoology and Palæontology in the Government School of Mines. He gave lectures in King's College, in the Royal Institution, in the School of Mines, and at Marlborough House; and he arranged the fossils of the splendid Geological Museum in Jermyn Street. He continued to prosecute his practical geological work in various parts of the kingdom, and published from time to time the results of his researches.

About the year 1846, he was attacked with a severe illness of a nephritic nature, during which his life appeared to be in great jeopardy. Although he recovered from the attack, yet the effects of it were frequently felt by him afterwards; and it seems to have laid the foundation of his fatal illness. He often remarked, that he appeared to possess great vitality, from having struggled through two such serious attacks; and, in his last illness, his hopes were for a time kept up by the idea he entertained of his vital powers.

Towards the end of the year 1846, he published, with Lieut. Spratt, his 'Travels in Lycia,' a classical work, containing interesting episodes in natural history, with a 'Sketch of the Botany of Asia Minor and the Ægean.' About the same time appeared his Monograph of the Southern Indian Fossils, in the

Geological Transactions, illustrated by the best plates of fossil Invertebrata ever done in England.

About this time he wrote on the connexion between the distribution of the existing Fauna and Flora of the British Isles, and the geological changes which have affected their area.

In 1848 his admirable Monograph on the British Naked-eye Medusæ was published by the Ray Society.

Subsequently appeared his Palæontological and Geological Map, contributed to Johnston's Physical Atlas, and in 1850 he completed, with Mr. Hanley, the splendid work on the 'Natural History of the British Mollusca and their Shells.'

His wonderful facility in all departments of science was due, Hooker says, to the early age at which he acquired its rudiments, and to the efficient practical training in systematic botany and collecting which he received in Edinburgh; to his quick perception of affinities, to his philosophical views of morphology, distribution, structure, functions, and the mutual relations of all these; to his mind being richly stored with the literature of the sciences; to the wide experience obtained during his travels; and, finally, to that heaven-given power of generalization and abstraction which he so eminently possessed.

In 1848 he married a daughter of the late General Sir C. Ashworth. It is curious to notice, that during that year four were married out of the ten who met to institute the Botanical Society.

In 1852 he published some valuable observations in regard to genera and species, in reference to which I received the following letter:—

"Jermyn Street, 19th June, 1852.

"My dear Balfour,

"The paper I sent you is a brief abstract of a long lecture*. It contains, in fact, only the table of contents, without the illustrations and comments: hence its obscurity.

"My notions about *genus* are these:—

"What we call class, order, family, genus, are all only so many names for *genera*, of various degrees of extent. It is in this sense I use the word *genus* in my lectures. Technically, a *genus* is a group to which a *name* (as *Ribes*) is applied, but *essentially*, *Exogens*, *Ranunculaceæ*, *Ranunculus*, are genera of different degrees.

"Now, one of the chief arguments in favour of the *naturalness* of genera (or *groups*, if you like), is that derived from the fact that many genera can be shown to be *centralized* in definite geographical areas (*Erica*, for example); *i. e.* we find the species gathered all, or mostly, within an area, which has some one point where the *maximum* number of species is developed.

"But, in *geographical space*, we not unfrequently find that the same genus may have two or more areas, within each of which this phænomenon of a point of *maximum* number of species is seen, with fewer and fewer species radiating, as it were, from it. [This is what I speak of under C, as *more centres than one in geographical* space.]

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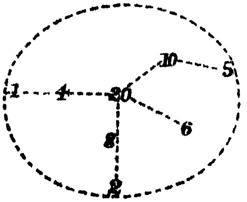
* [Inserted in the 'Annals' for July, 1852.]

Area of a genus.

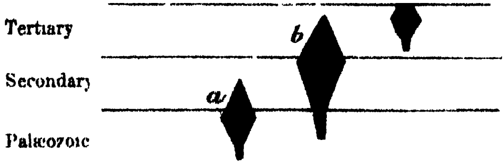


The numbers refer to species.

[This diagram is imaginary.]

Thus, *Viola* has an American as well as an Old World point of maximum of development, around which you may group the species, gradually diminishing in number.

"In *time*, however (or, in other words, in *geological distribution*), so far as we know, each generic type has had, so to speak, an unique and continuous range:—



Thus we find that all the species of genus *a* are grouped together within a succession of formations which commence at a certain point, and cease at another; so with *b*, so with *c*; but when once a *generic type* (as *Trilobites*) has ceased, it never reappears. Therefore I speak of a genus having an *unique centre* in time.

"Under *italic c* I say, that a genus is an abstraction, a divine idea. I think the very fact of the centralization of groups, of allied species, *i. e.* of genera, in space and time, is sufficient proof of this. Doubtless we make many so-called genera that are artificial; but a true genus is natural; and, as such, is not dependent on man's will.

"I dare say that I have only added obscurity to obscurity by this explanation; but, with diagrams, and time for talk, I think I could make the matter quite clear.

"Yours very sincerely,
"Edward Forbes."

He was elected in 1853 to the Presidentship of the Geological Society; and delivered, on leaving that office, an admirable address on the state of geology, which has been recently published.

In May 1854, on the demise of Prof. Jameson, he was called to the Chair of Natural History in this University. This had long been, to him, an object of his highest ambition. No one was so well qualified for it; and, had he been spared, he would undoubtedly have greatly extended its reputation, and would have made our university still more eminent as a school of science. Often had he stated in his letters, that he looked on Edinburgh as a place where the finest Natural History School in Europe could be formed. The Museum would, under his auspices, have mightily increased. Even during the short period he was with us, boxes of specimens were coming in from all quarters. He had resolved to dedicate himself to the work of arrangement; and his services in connexion with the New Museum of Economic Geology were looked forward to as of immense importance. The opening of the Museum to the public, and to all students of natural history, was an object he had in view; and he had already shown his liberal spirit by opening it to the pupils of natural history under Dr. Fleming at the New College.

He lectured last summer with the greatest success. His class amounted to 150, and all felt that they were listening to the prelections of a master-mind in science. Already had he inspired many with something of his own zeal; and his excursions to various places in the neighbourhood, such as Craigleith, Arthur's Seat, Inchkeith, Inchcolm, and Loch Lomond, were but foretastes of what he would have done in the way of practical geology. He had laid large and comprehensive plans, both as regards zoology and geology, and had commenced in earnest museum work.

Those who had the privilege of being with him in the class-room and in the field during his short career in Edinburgh as a Professor, saw something of his merits as an expounder of nature in a comprehensive way. He took an enlarged grasp of science in all its departments, and in all countries; his prelections were of a nature never yet equalled in Britain. With all his knowledge, he combined an affability, a modesty, a kindness, and patient perseverance which endeared him to every one. No student of nature was beneath his notice; no fact recorded by a pupil, however humble, was passed with neglect. He was ready at all times to be questioned, and was prompt to point out any spark of merit in others. He had no jealousy, and never indulged in attacks on others. He gave full credit to all, and was more ready to see the bright than the dark spots in the character. Even to those who had criticised him severely, he bore no ill will, and he certainly did not return railing for railing. He had a truly generous spirit, and was totally devoid of narrow bigotry. He was desirous of promoting science, independent of all selfish views. He loved it for its own sake. He had a noble temper, unaffected by good or ill fortune, and he was universally and deservedly beloved.

After his summer lectures he was busily engaged arranging matters in London He made excursions in different directions, and his last dredging was carried on with myself, Dr MacDonald, and Prof. Wyville Thomson, at North Berwick, in September last, previous to the meeting of the British Association. He attended that meeting in Liverpool, and occupied the chair in the Geological section. He made communications both to the Zoological and Geological sections. Few will forget the brilliant eulogium passed upon him by Prof. Sedgwick, at the conclusion of the business of Section C.

After the Association Meeting he spent some time in Dumfriesshire, and was there exposed, during an excursion, to wet, which was followed by shivering and febrile symptoms. These were supposed by him to indicate a return of his Ægean fever. When he came to Edinburgh he was by no means well, but much was attributed by him to being overworked. In spite of this he continued to labour, visited Mr. Murray of Monckland, for the purpose of observing geological phenomena, and vigorously set about preparation for his winter work, as well as for the 'Edinburgh New Philosophical Journal' (previously Jameson's), of which he and Dr. T. Anderson were now the editors He also revised his elaborate Paper on the 'Geological and Palæontological Map of Britain' for the new edition of Johnston's 'Physical Atlas.'

One of his latest productions was the article 'Siluria' in the last Quarterly Review, which concludes with this passage, so characteristic of his peace-making spirit:—

"Men whose work, both of head and hand, is done mainly under the broad sky, and along the craggy sides of mountains, heedless of weather and toil, are not likely to use mincing forms of speech or mollify their sentiments when engaged in discussions, though all the time mildness and mercy are at the foundation of their thoughts. Better and truer men, whether in field or council, there are not living than the two famous geologists, the nature of whose differences we have endeavoured to expound. They have worked long and well in co-operation, heart and hand united; and though the fortune of scientific war has led in the end to the crossing of their pens, the names of Sedgwick and Murchison will go down to posterity, side by side, and bracketed together in the glorious list of benefactors of mankind through the advancement of science."

He commenced his lectures on 1st November, 1854, and gave an introductory address, which has been found among his manuscripts, and will appear as a posthumous work in the January number of the Edinburgh New Philosophical Journal. He lectured for five or six days, and entered seventy-one pupils in his class roll. During all this time he complained more or less of febrile symptoms. These at last increased so much that he consulted Dr. Bennett, who at once ordered him to give up lecturing. This he did on Thursday the 9th of November, in the hope of being able to resume work on the Monday following.

On Saturday the 11th, I received a note from him, in which he enters fully into the reasons for not altering the hour of his lecture, as had been proposed by some of his colleagues. He very truly says, "For my own part I hold that to change any hour of lecture after the arrangements of the session are completed and advertised, is both deleterious and unbusinesslike * * *. The first consideration should be academical convenience; the next, the propriety, if there are to be changes, of announcing them a full session beforehand; the last, private convenience." He concludes by saying, "I was too ill to venture to the Botanical Society on Thursday."

During his illness he was very anxious about the Journal, and on Monday the 13th he wrote a note to me, in which he says, "I am completely shattered for the moment, and don't know how to get on with the Journal, being so ill. Could you look in upon me and advise? I am still in my bed." This is probably the last note he wrote.

I visited him on Tuesday, and found that he had been suffering great pain, and although the violent symptoms were relaxed, he was unable to converse with me. On Wednesday the 15th he was rather easier and was able to give me directions about the papers for the Journal; spoke with great anxiety about his pupils and his class, and gave a message to several of them.

From that time the disease increased, and the symptoms became of a very alarming nature. He was attended assiduously by his old friend Goodsir, along with Dr. Christison and Dr. Bennett; but all medical skill was unavailing. On the evening of Friday he gave his last directions, leaving his specimens to the College Museum, at Edinburgh, and his papers to Robert Godwin Austen, Esq. He continued to sink, and died at 5¼ P.M. on Saturday 18th November, being sensible to the last.

In announcing this sad event at the Council Board, the Lord Provost said it was his melancholy duty to notice the removal from amongst them by death of Professor Edward Forbes, one of the most distinguished ornaments of their University. Professor Forbes was appointed to the Chair of Natural

History so recently as May last, and the appointment, made by the Crown at the unanimous suggestion of the Council, was hailed by them and by the whole scientific world as an acquisition to the University, and as one which would in all likelihood tend to increase its celebrity in that department to which he had directed his attention. He had given a course of lectures during the summer, and had entered upon his winter course, when a disease of some standing suddenly removed him from among them He (the Lord Provost) knew that the Council would deeply mourn the loss which they had thus sustained. Professor Forbes had been cut off at the very commencement of what they had fondly hoped would be a career of increased usefulness in a position which it had been one of the dearest objects of his heart to attain. He (the Lord Provost) had to propose that the Council should express their deep sympathy with his bereaved widow and family at the loss which they in common with the community had sustained, and that, as a mark of respect to his memory, they should offer to attend his remains to the tomb.

The body was interred in the Dean Cemetery on Thursday 23rd November, near the burying-place of Professor Wilson, and the funeral was attended by his colleagues, the Lord Provost, magistrates, council, a large concourse of students, and nearly all the followers of science in Edinburgh.

Only a few days before his death he had been elected by the Royal Scottish Academy to fill the honorary office of Professor of Ancient History, in room of the late Professor Wilson.

Immediately after the funeral, a meeting was held at Dr. Bennett's house, which was attended by many of Forbes's friends in London, Edinburgh and the provinces, at which it was resolved to have a marble bust of him executed by Steel, to be placed in the College Museum. It was also proposed that a duplicate might be placed in the Jermyn Street Museum. Mr. Goodsir had taken a cast after death, which supplies important materials for the bust. It is expected that the model will be ready for the London Exhibition in May 1855, and the busts by January 1856. It is announced that his pupils in King's College, London, have met for the purpose of procuring a similar memorial of their late Professor.

At the request of several of his friends, Dr. George Wilson, one of his early companions, has kindly consented to draw up a memoir of him, and is now collecting materials for that purpose. It is hoped that all who can supply information in regard to the career of our late departed friend, will communicate as soon as possible with Dr. George Wilson at Surgeons' Hall. The memoir will probably appear as a separate volume.

I cannot more appropriately conclude this sketch of my departed companion, friend and colleague, than by quoting the statements made regarding him by four men of eminence, viz.—an anatomist, a botanist, a geologist, and a zoologist, who well knew his merits. Goodsir says, "Professor Edward Forbes was pre-eminently a naturalist. His attention had never been exclusively directed to any one of the Natural Sciences. He was equally a botanist, a zoologist and a geologist, from first to last. With a remarkable eye and tact for the discrimination of species and the allocation of natural groups, he combined the utmost delicacy in the perception of organic and cosmical relations. He possessed that rare quality, so remarkable in the great masters of Natural History, Linnæus and Cuvier, the power of availing himself of the labours of his brethren—not, as is too often the case, by appropriating their acquisitions, but by associating them voluntarily in the common labour. Entirely destitute of jealousy in scientific matters, he rather erred in overrating than in underrating the services of his friends. He was consequently as much beloved and confided in by his seniors in science as by the youngest naturalists of his acquaintance.

"Possessed of such comprehensive intellectual sympathies, Professor Edward Forbes has always been considered by his friends in Edinburgh and other places as the co ordinating spirit of his circle; and his return as Professor of Natural History was considered by all who knew him as a guarantee of the steady progress of his favourite science in the metropolis of Scotland. But, alas! by a dispensation of Providence, wise, doubtless, though inscrutable and painful to us, he has been cut off. Nevertheless, it may be, that short comparatively though his career has been, he has already, in his writings and in his influences on his friends and pupils, left behind him such germs of thought as shall hereafter develope themselves in the advancing science of the period, and so secure for our departed friend that full measure of scientific results which he ever longed after, not out of vain glory, for no man could be more free from such a feeling, but for the good of mankind and the glory of God."

Dr. Joseph D. Hooker writes:—"Endowed with real genius, possessing many and highly cultivated talents, no less conspicuous as an original thinker than as a hard and conscientious worker, accomplished in literature and art, equally graceful and ready with pencil or pen, in the lecture-room as in the closet, and with far rarer qualities than all these—the purest and most disinterested love of science, and the most generous appreciation of the labours of others—it is no wonder that he was beloved and admired beyond any natural historian of his day."

Hugh Miller, in the conclusion of his late admirable address on the fossiliferous deposits of Scotland, when resigning the chair of the Royal Physical Society, remarks: "I trusted to have had the honour of resigning the chair to a gentleman (Prof. E. Forbes) who, fifteen years ago, was one of the most active and zealous members of the Royal Physical Society; and who had, since that time, achieved for himself in natural science in general, and in geology in especial, a reputation co-extensive with the civilized world. But, alas! Death reigns. This distinguished man, in the full blow of his fame, and in the mature prime of vigorous manhood, has passed suddenly away; and wherever in either hemisphere physical science is cultivated, or the by-past history of our globe excites its legitimate interest, his early death will be felt and deplored as a heavy loss. The spoiler has broken abruptly off many a train of ingenious thought, cut short many a course of sedulous inquiry, arrested, just ere its formation, many a profound induction, and scattered hoards of unrecorded knowledge, the adequate re-gathering of which many years to come may fail to witness. But our idle regrets can neither restore the dead nor benefit the living. Let us rather manifest our regard for the memory of our illustrious brother—taken so unexpectedly from among us—by making his disinterested devotion to science our example, and by striving to catch the tone of his frank and generous spirit. And seeing how very much he succeeded in accomplishing within the limits of a life that has, alas! fallen short by more than thirty years of the old allotted term, let us diligently carry on, in the love of truth, our not unimportant labours, remembering that much may be accomplished in comparatively brief space, if no time be lost, and that to each and all that 'night cometh' at an uncertain hour, under whose dense and unbroken shadow no man can work."

Mr. James Wilson writes: "We should seek in vain to express the full measure of grief, we may say dismay, with which the unlooked-for death of this distinguished naturalist has filled all hearts. While his friends were in the first freshness of their elation at the prospect of the long and bright career which lay before him, and rejoiced in the force and efficiency of that impulse about to be given to the earnest study of the wonderful and manifold works of creation, this most skilful and accomplished interpreter has been suddenly removed from us, and his place now knows him no more for ever. Such dispensations are indeed inscrutable mysteries, and cannot be seen through even by those whose eyes are not bedimmed with tears. But, may all of us, and more especially the widow and the fatherless, bear in mind that 'the Lord reigneth.' He gives and He takes away, and let us bless His name, even amid the bitterness of unavailing sorrow."

BIBLIOGRAPHICAL NOTICES.

The Entomologist's Annual for 1855. Edited by H. T. STAINTON. London: Van Voorst, 1855. 12mo. With one Plate.

THE Editor of the "Entomologist's Annual" proposes, by means of this publication, to render British Entomology a service, very similar to that done for the science in general by the admirable reports furnished for so many years in Wiegmann's 'Archiv' by the late Dr. Erichson, and still so ably continued by Dr. Schaum. The information required is of course, to a great extent, of a very different character:—instead of a view of the general progress of the science, the collector of British insects desires only to know what new species may have been discovered in this country; what once rare species may have turned up in unexpected profusion, what changes may have been made in the nomenclature of well-known species; and, if he gets this information, coupled, perhaps, with an account of any discoveries made in connection with the transformations of British insects, which may enable him to procure good specimens for his cabinet, he will probably remain satisfied. To supply these wants, by bringing together at the commencement of each year the scattered information on British Entomology accumulated during that which has just elapsed, is the object of the present little work, which we have no doubt will prove highly acceptable to the class of naturalists for whose benefit it has been prepared.

The "Annual" for 1855, however, which must be regarded merely as preparatory, departs considerably from this general plan; consisting almost entirely of notices of the new species of Coleoptera, Aculeate Hymenoptera, and Lepidoptera discovered in Britain since the dates of the last general works upon those branches, with references to the English works in which the occurrence of these species has been recorded. The Coleoptera have been worked up by Mr. Janson, the Aculeate Hymenoptera by Mr. F. Smith, and the Lepidoptera by the Editor, and these reports, which are apparently executed with all the care and accuracy that might be expected from gentlemen whose attainments in their several departments are so well known, will no doubt prove exceedingly useful to many a student of British Entomology. The space occupied by these reports, extending, as they do, over periods varying from fifteen to more than fifty years, has necessarily precluded the insertion of any other information; but this cause of omission can, of course, only occur once. Amongst the Lepidoptera, the occurrence of several hitherto unrecorded British insects, including some new species, is noticed, and of these descriptions are given.

In his preface, Mr. Stainton gives us to understand, that, besides the miscellaneous information above alluded to, several papers of a lighter character, such as "Sayings and Doings at St. Osyth," by Mr. Douglas, and "Results of a Summer's Residence at Fochabers," by Mr. Scott, which, in his opinion, would have rendered the work more popularly attractive, have also been excluded from want of space. Mr. Douglas's "Sayings and Doings" may be everything that could be wished, and we must congratulate Mr. Scott upon the results of his residence at Fochabers, since they appear to have been so agreeable to that gentleman personally, that he wishes to make the Entomological public partakers of his happiness, as far as can be done by the imperfect medium of type, ink, and paper—a kind intention, for which he deserves great credit; but we think that such papers as these are hardly suited to the pages of this Annual,—about the last place in which we should think of looking for light reading.

The space to be devoted to these and similar articles might also be occupied in a manner which would add greatly to the value of the book, and prove highly acceptable to the generality of British entomologists, who are by no means notorious for an extensive acquaintance with foreign Entomological literature. Thus, a few pages might be devoted to notices of new observations, published in foreign countries, upon the habits and transformations of species of insects which also inhabit Britain, and a list of those foreign works published during the year which contain descriptions of insects which are, or may possibly be, found in these islands, would be a great assistance to many of our entomologists. If space still remained unoccupied, there is another branch of the science which has not yet been thought of—the anatomy and physiology of insects. Short abstracts of important papers on these subjects would not be out of place, and would not only be useful to the few who devote themselves to such pursuits in this country, but might have the effect of adding greatly to their numbers.

With these suggestions we take leave of the "Entomologist's Annual for 1855," wishing it every success, and trusting that each succeeding volume may show such an improvement upon its predecessors, that, in the course of a year or two, their resemblance to their present "larval" representative may scarcely be greater than is exhibited by the Editor's favourite insects in their first and last states.

A Catalogue of British Fossils, comprising the Genera and Species hitherto described; with references to their Geological Distribution and the Localities in which they have been found. By JOHN MORRIS, F.G.S. Second Edition, considerably enlarged. 8vo. London, 1854. Printed and published for the Author (Kensington).

Since the time when it was discovered that particular fossils are characteristic of certain deposits, and that thereby, as a general rule, fossiliferous strata of districts even remote from each other may be identified as contemporaneous deposits and members of one stratigraphical series, the science of geology has attained an established position, and has proved not only of interest to the philosopher, but of value to the practical man. Geologists therefore have necessarily given increased attention to the study of petrifactions or fossilized organic remains; and the science of Palæontology has rapidly advanced, keeping pace with the researches of zoologists and botanists devoted to the study of existing nature.

Mr. Morris's 'Catalogue' affords us the results of the numerous examinations of the fossils of the British Islands, both by native and foreign palæontologists. These researches, scattered through numerous works—periodical, monographic, and miscellaneous—were of limited value until brought within the reach of geologists in such a compendious form as the work now before us.

However well acquainted one may be with the bibliography and natural history of one or more groups of fossil creatures, whether bivalves, cephalopods, fishes, or any other,—and however readily he may exchange his knowledge with his fellow-workers in palæontology and give assistance to the practical geologist, yet, from the loss of time in hunting up references and figures of fossils,—the uncertainty of memory,—the mislaying of note-books, and a hundred other reasons, we well know that geological work cannot satisfactorily proceed without our having at hand a trustworthy book of reference to all described and figured species of organic remains.

Some ten years ago Mr. Morris produced such a work, thereby supplying the want then felt, and which the partial lists of fossils already compiled could not meet Since 1843 geologists have extended their researches, both over new localities, and in parts of the organic kingdom previously but little studied, and an enormous increase of palæontological observations has been the result That these observations should prove of their full value, it was high time that they should be reduced to order and brought to the test of strict comparison. With renewed energy and increased knowledge the author has again applied himself to the crowd of names and synonyms, and has now marshalled in alphabetical array, in their several classes, families, orders, and genera, upwards of 8300 species of British fossils.

In carrying out this arrangement the author submitted some sections of his work to those of his scientific friends who had respectively paid attention to the several groups of fossils, and the assistance rendered him in these departments the author freely acknowledges in the Preface, where he assigns to each his due, and carefully notices the public and private collections from which he has gathered information and received assistance.

Many of the palæontographical notes and memoirs recently published, especially in the case of monographs, have done much to the correction of the nomenclature of the subject. Of these Mr. Morris has fully availed himself.

The following Table exhibits the numerical proportions of the several palæontological groups for Great Britain and Ireland (and approximately for Europe and elsewhere),—together with the difference of numbers of the organic remains enumerated in the previous edition compared with those now catalogued.

					2nd Edition		1st Edition.		Additional.	
					Genera	Species.	Genera	Species.	Genera.	Species.
Invertebrata	Acrita		Plantæ		123	655	109	530	14	125
				Diatomaceæ	21	71	5	6	16	65
			Amorphozoa		31	139	18	77	13	62
				Xanthidium	1	14	1	14	0	0
			Foraminifera		37	182	27	82	10	100
	Radiata		Zoophyta		127	435	35	180	92	255
			Echinodermata		99	492	66	260	33	232
	Articulata		Annelida		19	132	13	79	6	53
			Cirripedia		8	44	7	21	1	23
			Crustacea		80	298	48	161	32	137
			Insecta		58	...	13	..	45	...
	Mollusca	Acephala	Bryozoa		62	258	30	130	32	128
			Palliobranchiata		31	619	14	452	17	167
			Lamellibranchiata	Monomyaria	26	572	20	330	6	242
				Dimyaria	106	1069	78	725	28	344
			Rudista		1	1	4	4	0	0
		Encephala	Pteropoda		5	13	3	7	2	6
			Gasteropoda	Opisthobranchiata, Pulmonifera, and Prosobranchiata	145	1596	119	818	26	778
				Nucleobranchiata	3	45	2	29	1	16
			Cephalopoda		28	675	21	467	7	208
Vertebrata	Pisces				238	741	148	540	90	201
	Reptilia				48	153	33	91	15	62
	Ichnites				7	29	2	2	5	27
	Aves				11	11	7	7	4	4
	Mammalia				56	96	33	52	23	44
			Incertæ sedis		8	19	7	10	1	9
					1379	8359	863	5074	519	3288

We will now offer some remarks on the separate groups above tabulated; reminding our readers that not merely do the differential numbers indicate the addition of a large mass of published material to the lists (viz. 3388 species), but that, besides the absolute numerical increase of species, an important change has often taken place in the presumed generic and specific relations of previously recorded fossils, tasking the critical acumen of the Author and demanding much labour. This result cannot be readily seen by the figures, but practical palæontologists will quickly discover it, and it may be seen in even a cursory comparison of this with the former edition.

The increased number of recorded fossil Plants is chiefly derived from the Jurassic and Tertiary beds. To those from the latter should also be added the twenty-two forms of fossil leaves, &c. from the Lower Eocene clay of Reading, figured by Mr Prestwich, and the other tertiary plant-remains described by the same geologist, and, with the former, noticed in the "Addenda" of the 'Catalogue,' p. 363, where from 300 to 400 species of fruits from the London Clay in Mr. Bowerbank's collection are also referred to as being still undescribed. The Diatomaceæ are in this edition grouped with the plants (at p. 25), in accordance with the corrected notions of naturalists with regard to the affinities of these organisms. Doubtless this short list of the siliceous infusoria may be increased by judicious microscopical research, but we cannot too strongly urge upon those who may take in hand the examination of any deposit with the view of searching for these remains and enlarging the bounds of "Microgeology," that the utmost care should be taken that the examination is made with hands and instruments innocent of errant infusoria, and in fact in apartments into which stray Diatomaceæ do not come. Rich fields for palæobotanical research are still open in the London Clay, and in the tertiary plant-beds of Newhaven, Alum Bay, Bournemouth, Poole, and Corfe; and, not to speak of the Jurassic coal-deposits, we must remind geologists that the Carboniferous flora of Great Britain has not nearly received the labour it deserves of our geologists and palæobotanists, and that it requires much attention before it can be fairly compared with the "palæozoic" floras of the Continent and other regions. We may here observe that Dr. Hooker's notice of the *Trigonocarpon*, read before the Royal Society, refers this fruit to the Coniferæ; a correction to this effect may be made at p. 24 of the 'Catalogue.'

A large proportion of the increase of the Amorphozoa is due to the addition of the thirty-six species (belonging to four genera) of the Ventriculidæ, so elaborately worked out by Mr. Toulmin Smith. The position here assigned to this group does not accord with that advocated by their investigator. As their assumed polyzoan character has not been generally accepted, nor their exact relations recognized, probably they owe their present location solely to the hospitality of the Amorphozoa, and may be they rest contented, on the principle that a "home is home however homely."

From the large access of species and the numerous indications of undetermined or unpublished forms in the list of the Foraminifera, it appears that much may be expected of future investigators of these curious microscopic forms. The not unfrequent occurrence of lengthy lists of synonyms, especially at pages 33, 37, 39, and 41, may be referred to as an indication not only of the interest taken in this group by the author and his friends (Messrs. S. V. Wood, T. R. Jones, and W. Harris) to whom he refers in the Preface, but also by numerous naturalists of ancient and modern times. Some of the genera appear to be common to several formations, *e g. Textularia*, coming down from the Carboniferous Limestone and Permian to the Tertiary and Recent Epochs (and we may add that this genus occurs also in the Upper Silurian), but others are limited in their vertical range, and furnish more reliable characteristic species for the geologist. Among these latter the Nummulite is pre-eminent; although the important exceptions of a few peculiar ancient Nummulitoid forms,—from the Upper Jurassic of the Dep. de la Meuse (Buvignier), the Lias of Fretherne, Gloucestershire * (Jones), and the Carboniferous Limestone of Miatschkous, Russia (Rouillier), as well as another, similar perhaps to the last, from the Upper Silurian of Shropshire,—must not be lost sight of by the palæontologist. The specific forms of the Nummulite, though very closely allied and subject to individual vagary and local variations, are highly characteristic, and play an important part on the tertiary stage. A masterly sketch of the zoological and geological relations of this interesting genus, comprising a review of M. D'Archiac's monograph, occupies several pages of the Presidential Address delivered to the Geological Society of London, February 17, 1854, by the late and most sincerely lamented Prof. E. Forbes.

In the former edition both the Bryozoa and the Anthozoa were included under Zoophyta. The former (so often confounded by amateurs and others with Corals, and not unfrequently also erroneously termed Corallines), being now regarded as molluscan in their relations, are separately grouped. The Zoophytes, as they now stand (Anthozoa or Corals), exhibit a very extensive augmentation of species, resulting from the labours of Messrs. Lonsdale and M'Coy, and their French collaborateurs, MM. M.-Edwards and J. Haime.

In noticing the present advanced state of our knowledge of the fossil Echinodermata, as exhibited in the 'Catalogue,' we have again to refer to one whose loss the scientific world deplores and whose early departure bereaves so many sorrowing friends. Prof. E. Forbes and Messrs. Austin, M'Coy, and Wright have worked well in this department; the addition of the Cystideæ and the very complete and well-determined list of the other forms render this portion of the 'Catalogue' of the greatest value. Not only for a large proportion of the material of this list, but for its arrangement and revision, we are indebted to the lamented chief of British palæontologists. The chief additions to the Annelida are palæozoic species; and several neozoic species are brought into position under *Vermicularia*.

The Cirripedia, both fossil and recent, have of late, as naturalists well know, been critically examined by Mr. C. Darwin. The list, as it now appears, doubled in number and highly valuable for its accuracy and completeness, has been founded on Mr. Darwin's Monographs, and has been subject to his revision.

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* Annals and Mag. Nat. Hist. 2nd Ser. vol. xii. p. 275

The large number of species accruing from recent researches among the fossil Crustaceans is an important element in this catalogue, and indicates the industry of the observers. The extensive corrections, also, of the generic affinities imply a great amount of labour and a decided advance in our palæontological knowledge of this interesting subclass of the Invertebrata. The Malacostraca, or higher forms, are but few in proportion to the Entomostraca. They afford only 46 species, in 26 genera, and are chiefly jurassic, cretaceous, and eocene. Their present arrangement and nomenclature are mainly due to Prof M'Coy. Of the Entomostraca there are three groups which are worthy of notice. Firstly, the Trilobites so characteristic of the Lower Palæozoic rocks. They are very numerous and present 139 species, in 35 genera. The revision of this group has occupied the attention of several foreign and British palæontologists, we may allude to Barrande *, M'Coy, and Salter In the preface of the 'Catalogue' Mr. Salter's thorough revision of the list of the British species is specially acknowledged. The second group referred to consists of 32 species of Phyllopods and Pœcilopods, in 10 genera, which are chiefly palæozoic, and known by Salters's and M'Coy's descriptions Some of the Limnadiadæ, however, from recent unpublished observations, appear to range from the Devonian to the present epoch. Thirdly, the microscopic Ostracoda; of these, 81 species, in 9 genera and subgenera, have been arranged in the catalogue by Rupert Jones. At present the majority appears to belong to the Carboniferous, Permian, Cretaceous, and Tertiary formations. Those of the first are chiefly Prof. M'Coy's species; the next two groups have been monographed by Mr. R. Jones; and the tertiary British forms await a similar treatment. In the mean time geologists have M. Bosquet's beautiful treatise on the tertiary Entomostraca of France and Belgium to refer to. The jurassic strata will probably yield their share in due time. Extensive undescribed collections exist. Altogether, this extensive member of the Entomostracous group promises to afford useful characteristics for the geologist.

The fragmentary and obscure conditions under which Insect-remains are usually found have rendered it difficult for Mr. Westwood, Mr. Brodie, and their fellow-labourers to specify the exact relations of the many specimens from the Lias, Great Oolite, Purbeck, and other formations. The numbers given in the above Table are only approximate; the specimens themselves are exceedingly numerous. In the "Addenda," the discovery of Insect-remains in the Wealden by the Messrs. Binfield is noticed, as well as the researches of Mr. Brodie and Mr. Westwood in the Purbeck Insects of Dorset. Mr. Westwood's memoir has since appeared, with numerous illustrations.

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* See Annals and Mag. Nat. Hist. 2nd Ser. vol. xii. p. 130.

In the Mollusca, as a whole, we have the enormous increase of 1889 species, in 119 genera. The annexation of the Bryozoa, and the enlarged lists of the Palliobranchiates, Lamellibranchiates, Gasteropods, and Cephalopods, make up the mass of the added material. It is impossible to analyse this here. To enumerate the authors of this increase in the bulk and improvement in the arrangement of these species, we must catalogue the palæontologists themselves who have worked together during the last ten years,—and amongst them Mr. Morris himself, as an eminent historian of the fossil molluscs and of the conditions under which they lived. And, alas! too, we should have to recall the names of some, dearly lamented, who have been taken from amongst us before their hands were weary of hammer or of pen.

We refer then to the Preface and to the Book itself for indications of the work done in this wide department by the collectors, the authors, and the compiler of the 'Catalogue;' and we will offer but one or two special remarks.

Amongst the most important points connected with the emended catalogue of the Molluscs, we must notice that in the family of the Palliobranchiates several good distinctive groupings have been usefully introduced. Thus the large group formerly comprised under *Terebratula* has now been subdivided into *Terebratula* and *Rhynchonella*, so well characterized not only by the peculiar position of the foramen and by the external aspect, but also by the marked difference of the internal calcareous appendages. As minor divisions of the original group, we find *Argiope*, *Terebratulina*, *Terebratella*, and others carefully distinguished. The genus *Siphonotetra*, previously recognized only as a Russian form, is an interesting addition by the Author himself to the British list. Why the bad word "Brachiopod" should be retained when every body is willing to allow its inappropriateness for a creature that has not in any sense either *arms* or *feet*, we cannot tell, unless it be on account of the determined adhesion of some modern naturalists to the habit of naming things on the *lucus a non lucendo* principle. This would have been a proper opportunity for throwing overboard an incorrect word, the place of which is already well supplied.

The Radiolites may now follow *Diceras* into the Dimyaria, and take their place near the Chamidæ, in accordance with Mr. S. P. Woodward's elaborate exposition of the alliances of the Rudista lately read before the Geological Society; this view is also explained in his valuable and concise 'Treatise on Shells' lately published.

Amongst the mollusca there are several genera that are very rich in the number of their species. In these instances the species are grouped either in the great geologic or the smaller stratigraphical series, as most convenient for the student. Thus *Avicula*, *Nucula*, and *Natica* have their palæozoic, secondary, and tertiary groups; and *Rhynchonella* and *Terebratula* are sorted into palæozoic, oolitic, cretaceous, and tertiary.

Lastly, we have occasion to remark that the locality of "Bracklesham," so important as indicative of a peculiar formation, is occasionally omitted in connection with the middle eocene species in the 'Catalogue.' This may be corrected by reference to 'Dixon's fossils of Sussex and Hants.' The lists of London Clay and Bracklesham fossils just published in the 'Quart. Geol. Journal,' by Mr Prestwich, may be here mentioned as valuable adjuncts to this portion of the 'Catalogue.'

For the augmented and revised list of the Fishes the author acknowledges his obligation to Sir P Egerton, who, with Professor Agassiz, has so eminently advanced our knowledge of palichthyology.

The additions to the Reptiles have been compiled chiefly from the publications of Prof. Owen and the late Dr Mantell The newest additions are the *Nuthetes* and *Macellodus*, discovered early this year in the Purbeck rocks near Swanage. In the present edition we find a page devoted to Ichnites, or the footsteps and tracks of Reptiles, including the *Cheirotherium*, the interesting series from Corncockle Muir, and perhaps nearly every instance published in English works The footmarks in the Wealden, as yet of doubtful origin, have since been made the subject of a memoir by Mr. Beckles.

The short list of fossil Birds increases but slowly from year to year. To the present list, however, there is still a brace or so from the Caves to be added, besides an interesting relic from the Lower Eocene beds near Woolwich, noticed by Mr Prestwich in the 'Geol Journal' of May 1854. Since the Catalogue was published Mr. Bowerbank has described another bird's bone from the London Clay of Sheppey

The augmented Catalogue of Mammalia speaks everywhere of Prof. Owen's labours. The *Spalacotherium tricuspidens* (misprinted in the 'Catalogue') is the latest arrival. Its affinities and geological value are dwelt upon fully in Prof Owen's memoir in the 'Geol. Soc. Journal.' Mr. Charlesworth's new mammal (*Stereognathus*) from the Stonesfield Oolite is a good beginning for the Supplement, which we hope will soon have to be made for this valuable 'Catalogue.'

The list of organic remains *incertæ sedis*, though relieved of a few now better understood forms, is still the receptacle for a variety of dubiums and problematicums from various geological sources. The *Parka decipiens*, of Fleming, may be added to this list with propriety, to take its chance with the others of being elucidated by the perseverance, the acumen, and the good fortune of palæontologists. With this list of puzzling odds and ends,—and very few they are in comparison with the 8359 species enumerated in the 'Catalogue,'—we close our remarks on the results afforded by the foregoing Table.

Of the natural groups into which the materials of the 'Catalogue' are thrown, nearly all have a more or less elaborate table of families, and sometimes of genera, prefixed. These appear to have been constructed with special reference to palæobotany and palæozoology, and they will prove of great service in keeping the remembrance of the natural orders and affinities distinct in the mind of the student and the amateur. Such comprehensive tables for the Plants, Crustaceans, and the Fishes in particular, could not be found elsewhere.

The chief object of the author of the valuable compilation under notice has been to supply references to the best figures that have been published of the fossils of the British Isles, including, if possible, the earliest illustrations; so that all the "types" may readily be found. Occasionally more latitude has been allowed, and the references to the figures and descriptions indicate everything that has been published on the respective species. In all cases, monographs that embrace the bibliographical history of the several forms are carefully adverted to.

Hence this work is eminently useful to the geologist and palæontologist, for it assists them in the strict determination of the species peculiar to each formation, and they are hereby enabled without loss of time to prove the full value of their observations and collections, to draw up lists of the fossils of their respective neighbourhoods, compare the fossil products of various localities, and advance the knowledge of both practical and theoretical geology in the British Isles.

And not only in our own country, but in Europe, America, India, Australia,—wherever geology is studied, this work will be found of essential service. For although all the references to foreign works are not given (English publications having generally the preference), and though the foreign localities of species not peculiar to the British Isles are not always mentioned,—yet, in common with geologists at home, our foreign brethren in the science will find Mr Morris's unpretending work a rich mine of palæontological knowledge, ever ready to yield information to the student in his researches in bibliography, or in his examination into natural-history affinities.

That foreign naturalists fully appreciated the value of the 'Catalogue' in its first edition, the "European reputation" which the author earned by its production is sufficient evidence; and the general 'Index' by Bronn and his colleagues, and some of the valuable Catalogues by D'Orbigny, Giebel, Geinitz, and others, whether general or local in their characters, have avowedly had "Morris's Catalogue" for their example.

The general catalogues above referred to are highly valuable, and are indeed often indispensable to the student,—for they afford synopses of all the known fossil forms of animal and vegetable life, and of their distribution in the geologic series (as far as the accounts of the very numerous observers can be reduced to an orderly arrangement); and moreover the German authors have laboured to supply every bibliographic reference, of whatever value, for each species; yet the great desideratum of strict specific determination, combined with an exact indication of stratigraphical and geographical locality, is only supplied in such a work as that before us.

Prof. J. Phillips has well observed that "the most important results to geology, arising from the contemplation of organic remains, are founded on a minute scrutiny of their specific characters, and a careful register of their localities in the strata. It is not enough for the rigid accuracy of modern inquiry, to say that a given rock contains corals, shells, and bones of fishes; but we must know the particular species, and determine all the circumstances of their occurrence. The more exact and extended our researches on this subject become, the more clear will be our statements on the succession of created beings, the more certain our applications of zoological principles to determine the relative antiquity of rocks, and the more satisfactory our views of the formation of the strata."

In recommending this new and enlarged edition of Mr. Morris's 'Catalogue' to the careful study of the geologist and the natural-history student, we must express our hope that the Author will edit at frequent intervals, supplemental notices of the new species as they accumulate, as well as a set of synoptical lists and tables compiled from the present work, exhibiting at a glance the stratigraphical distribution of the families, genera, and species of fossils found in Great Britain and Ireland. This, though seemingly but a clerkly task, will require the careful supervision of a master.

Popular Conchology. By Agnes Catlow. Second Edition.
London: Longmans, 1854. 12mo.

In this little book, of which a second edition is now before us, Miss Catlow has brought together, in a popular form, the characters of the genera of Mollusca; and although the work is, of course, almost entirely a compilation, the fair author appears to have exercised considerable judgment in the selection of materials, and her book, we should think, will prove exceedingly useful to the younger students of this branch of zoology.

The system adopted in the present edition is derived from that given by Philippi in his 'Handbuch,' founded upon the structure of the molluscous animals. In the first edition, Lamarck's shell system was followed. The generic characters are generally copied from the works of other authors, and, in most cases, the number of species included in each genus is given from the most recent authorities Most of the genera are illustrated with very good woodcuts of the shells, which will greatly facilitate the work of the young conchologist in the arrangement of his collection.

There are some things, especially in the introductory chapter on the structure of the Mollusca in general, which might have been improved with very little additional trouble, but which would have rendered the book far more satisfactory. As an instance, we may refer to the very curious account given by our author of the mode of formation of shell. She tells us that from the mantle "a liquid exudes, which, on exposure to air or water, hardens into shell,"—an explanation of the phænomenon which we fear will hardly prove satisfactory to an inquiring mind. On the whole, however, Miss Catlow has produced a book which will no doubt be highly acceptable to a very large class of readers.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

December 14, 1852.—Dr. Gray, F.R.S., V.P., in the Chair

ON THE PAINTED PIG OF THE CAMAROONS (POTAMOCHŒRUS PENICILLATUS).

BY JOHN EDWARD GRAY, PH.D., F.R.S., V.P.Z.S. ETC.

This Pig was imported into Liverpool, where it remained some time, being regarded as the common Cape "Bosch Vark." It was at length purchased by the Society, and is one of the most interesting additions made during the course of the present year to the very numerous series of animals now in the Gardens.

It differs in colour and proportions from the Cape "Bosch Vark," but like it belongs to a very distinct group of Pigs from those found in Europe and Asia, and from the *Babyrussa* of the Malay Islands.

In the 'Annals and Magazine of Natural History' for October 1852, I gave a short account of this animal, and formed a genus for this group of African Pigs, to which I gave the name of *Choiropotamus*, describing the present species by the name of *C. pictus*, and it is figured under this name in the 'Illustrated London News.' Since these notices were published, I have found that it will be necessary to change both these names; the first because there is a genus of fossil animals described by Cuvier, which has been called *Cheiropotamus*. I therefore propose to reverse the words and call the genus *Potamochœrus*. The specific name is changed because the pig appears to have been described in 1848 from a specimen in the Museum of the town of Basle in Switzerland, in a work which has not yet reached this country, but a short abstract of the description has been copied into a French Journal.

The group of *Pigs* (Sus, *Cuvier*) may be divided into three very well-marked genera, distinguished by their external appearance, peculiarities in the skull, and by their geographical distribution, thus:—

Genus 1. SUS.

The ears rounded; tail slender; face conical, simple, or with a small wart on each cheek; the hinder upper part of the intermaxillary bones simple; the upper canines coming out on the lower edge of the maxilla and then recurved. Found wild in Europe and Asia, but domesticated in all parts of the world.

This genus contains several species, and almost the whole of them are found wild in the forest, whilst some of their descendants are generally to be met with in a domesticated or semi-domesticated state. This is the case with the Pigs found in the islands of the Indian Archipelago, which have been regarded as distinct species.

I may state that it is exceedingly difficult to distinguish the species of this genus, especially from the examination and comparison of the skull. I have examined with care ten skulls of what I believe to be the European Wild Boar and its offspring, grown in this country, at the Cape of Good Hope, and at the Gambia, and twelve skulls of the

Wild Boar from Continental India, and though they offer considerable variation, I cannot discover any constant easily-described character by which I can distinguish the European and the Indian kinds from each other, and this is the case with many other genera allied to the Pigs. We have in the Zoological Gardens the Wild Boar of Europe and a Wild Boar and Sow from Madras living side by side, and they have all the appearance of being most distinct species, which may be thus characterized :—

SUS APER.

Covered with crowded bristles, forming a crest on the withers; black speckled, with grey tips to the bristles, the legs hairy, black, hoofs black.

Hab. Europe, Germany.

SUS INDICUS.

Covered with scattered, more rigid bristles, more abundant on the front part of the body, pale grey, blackish on the outside of the shoulders; legs slender, covered with a few bristles; hoofs white.

Female (perhaps half-bred).—Body rather more hairy, the outer front hoof of each hind foot black.

Sus Indicus, Gray, Cat. Mam. B.M.

Hab. India, Madras.

The skulls of the Wild Hogs from Madras and the Himalaya in the British Museum all appear larger, and have the hinder part of the forehead not so high and dilated as in the common Domestic Boar, much resembling the skull of the sows of that species. They can scarcely be all from female animals of the Indian kind.

I may observe that the nasal bones of this genus appear to elongate and occupy a greater part of the length of the face in the adult than in the young animal. In the young they seldom extend beyond a line even with the large foramen on the side of the face, but in the adult they are generally produced much behind it.

Genus 2. BABYRUSSA.

The ears rounded, tail and limbs slender; face conical, simple; the hinder upper part of the intermaxillary bone smooth; the upper canines (in both sexes) coming out from the side of the jaw and bent upwards from the base, and then arched backwards, sometimes even spirally recurved. *Hab.* The Indian islands.

1. BABYRUSSA ALFURUS.

Genus 3. POTAMOCHŒRUS.

The ears elongate, suddenly tapering and ending in a pencil of hairs, face elongate, with a long protuberance on each side halfway between the nose and the eye; the tail thick, high up the rump; the upper part of the intermaxillary bone swollen, rugose; the upper canines arising from a prominent bony case on the side of the jaws, coming out on the lower edge of the jaw and then recurved. *Hab.* Africa.

***Koiropotamus,* Gray, Cat. Mam. B.M. xxvii.**

Choiropotamus, Gray, Ann. & Mag. N. H. 1852 (not *Cheiropotamus*, Cuvier, Oss Foss.).

1. POTAMOCHŒRUS AFRICANUS

Black, cheeks whitish, with a large central black spot.

African Wild Boar, Daniel, African Scenery, t. 22 ♂.

Sus africanus, Schreb. Saugth. t. 327, head.

Sus larvatus, F. Cuvier, Mém. Mus viii. 447. t. 22. Blainv. Osteog. xvii. t. 5 *f.* t. 8 *f.*

Choiropotamus africanus, Gray, List Mam. B.M. 185.

Choiropotamus larvatus, Gray, Ann & Mag. N. H. 1852.

Sus koiropotamus, Des Moul. Dict. Class. H N. Atlas, t. 7 ♀.

All the specimens which have come under my notice are coloured as above described. But Dr. Andrew Smith (Zool. South Africa) observes, scarcely any two specimens are of the same colour, some are brownish black, variegated with white, and others almost entirely uniform light reddish brown.

2. POTAMOCHŒRUS PENICILLATUS

Bright red bay, face, forehead, ears and a large spot on the front of the legs black, edge of the ears, whiskers, streaks over and under the eye, and a continued sub-crested streak along the middle of the back white, hair of the back short (black at the base), of the sides and whiskers elongate, tail very long, thick.

Sus penicillatus, Schinz, Monog. Saugth. 1848, fide Rev. Zool. 1848, 152.*

Choiropotamus pictus, Gray, Ann. & Mag. N. H. 1852.

Painted Pig of the Camaroons, Illustrated News, 1852.

Hab. W. Africa. River Camaroon. "Gold Coast, Mus. Basle," fide *Schinz*.

A fine male of this species has been living in the Gardens of the Zoological Society since September 1852.

ON THE HORNS OF THE SANGA, OR GALLA OXEN, OF GIBBA.

BY J. E. GRAY, PH.D., F.R.S., V.P.Z.S.

Dr. Gray brought before the Society a pair of horns of these oxen, which the British Museum had lately purchased at the sale of the property of the late Earl of Mountnorris, at Arley Hall.

They are the pair mentioned by Mr. Salt in his 'Voyage to Abyssinia,' at p. 258, 4to edit. 1811, where he observes:

"There (Gibba) for the first time I was gratified by the sight of the *Galla* Oxen, or *Sanga*, celebrated throughout Abyssinia for the remarkable size of their horns. Three of these animals were grazing among the other cattle in perfect health, which circumstance, together with the testimony of the natives, 'that the size of the horn is in no instance occasioned by disease,' completely refutes the fanciful theory given by Mr. Bruce respecting this creature.

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* I have seen the specimen in the Basle Museum, and it is certainly the species here described, only differing a little in the depth of the colouring.—J. E. G.

"The Ras having subsequently made me a present of three of these animals alive, I found them not only in excellent health, but so exceedingly wild, that I was obliged to have them shot.

"The horns of one of these are now deposited in the Museum of the College of Surgeons, and a *still larger pair are placed in the Collection of Lord Valentia, at Arley Hall.* The length of the largest horn of this description which I met with was nearly four feet, and its circumference at the base twenty-five inches.

"I shall only further observe that its colour appears to vary as much as in the other species of its genus; and that the peculiarity in the size of the horns was not confined to the male, the female being very amply provided with this ornamental appendage on her forehead, pp. 258, 259. See also Bruce's 'Voyage,' App. 1. Letters 9 & 10."

Dr. Gray observes that the horns are shorter, and more curved and lyrated than the figure engraved in t. 19, at p. 259 of Salt's 'Travels in Abyssinia,' which also appears to make them bear a larger proportion to the size of the animal than the specimen suggests, and they are quite as remarkable for their erect position on the forehead as for their size.

They and the core which supports them are very light, compared to their size, and not half the weight of the smaller wide-spreading horns of the long-horned Cape Waggon Oxen. The horns are thin, pale coloured, and of a loose texture, being worn and fibrous on the surface in several parts.

In the lightness and very cellular structure of the core, the thinness of the horny coat, and the large size, they agree with the pair of horns in the British Museum brought from Central Africa by Captain Clapperton, R.N., and Major Denham, R.E., which are figured in Griffiths' 'Animal Kingdom,' vol. iv. t. 201. f. 4; but these horns are shorter and much larger in diameter, and are spread out on the sides of the head like those of the Common Domestic Oxen, and they are very much lighter for their size than those of the *Galla Oxen* or *Sanga*.

Sir Richard Vivian has kindly informed me that he has seen a breed of cattle in Italy, with the horns rather erect, somewhat resembling those of the *Sanga* in position.

DESCRIPTION OF A NEW GENUS AND SOME NEW SPECIES OF TORTOISES. BY JOHN EDWARD GRAY, PH.D., F.R.S., V.P.Z.S. ETC.

Fam. 1. EMYDIDÆ.

1. MANOURIA, n. g.

Animal unknown. Shell rather depressed; caudal plates double, separate; sternum solid, broad, produced and slightly nicked in front, notched behind, with only five pairs of broad shields; pectoral shields short, subtriangular, only occupying the angle between the outer edge of the humeral and abdominal shields; axillary shields small, inguinal larger; the areola of the discal shields central.

The depressed form and divided caudal plates induce me to place this genus in *Emydidæ*. In external appearance it much resembles the North American Land Tortoise, *Testudo gopher*, but it is at once known from that species, and all the other genera of *Testudinidæ*, *Emydidæ* and *Chelydidæ*, by the peculiar form of the pectoral shields, which at first sight might be mistaken for a very large-sized inguinal shield, if that plate were not also present.

In this respect it somewhat resembles the genus *Kinosternon*, but there the shield is only narrower at the inner end, and rather nearer to the centre of the sternum.

Various genera of *Testudinidæ* have the pectoral plate much smaller than the others; and perhaps the small size of the pectoral shield in this genus shows its affinity among the *Emydidæ* to that family.

If it were not for the irregular division of the caudal plates, and the form of the pectoral plate, it might be regarded as nearly allied to the very variable *Testudo Indica*.

1. MANOURIA FUSCA.

Pale brown, nearly uniform, discal shields concentrically grooved, with a central areola, the anterior and posterior lateral margins acute, slightly sinuated and rather bent up; the humeral and abdominal plates longer than broad, the abdominal very large; the gular produced, narrowed in front.

Hab. Singapore.

Unfortunately we only possess a single very imperfect specimen of his very interesting Tortoise, wanting several of the discal shields

2. EMYS LATICEPS.

Shell pale olive, yellowish beneath; sides rounded, hinder lateral margin rather expanded and recurved, hinder end rather compressed above, shields thin, transparent, inferior plates with a narrow black edge, head large, short, broad, covered with a smooth skin; neck with very narrow yellow lines.

Hab. West Africa, River Gambia (*M. Castany*).

This is the *only* Emys yet found in West Africa, and is easily known by its short broad head.

Fam. 2. CHELYDIDÆ.

3. HYDROMEDUSA SUBDEPRESSA.

Shell oblong, depressed, dark brown, entire, rounded in front, rather angular behind; nuchal plate short, broader than the post-vertebral, post-vertebral square, as long as broad, with the front angles produced; sternum pale brown; gular plates short, unequal; head grey; lips and beneath white; neck with small conical warts.

Hab. Brazils.

There is in the British Museum collection a single adult specimen of this species, which has some of the plates of the back and sternum divided into a number of small roundish shields.

The specimen was sent from Brazil to Mr. Brandt of Hamburg, who transmitted it to the Museum. It may be only a variety of *H. flavilabris*, but the nuchal and post-vertebral shields are very differently shaped.

4. HYDRASPIS SPIXII, Gray, Cat. Rept. B. M. 30.

Shell oblong, depressed; middle of the back flat; marginal shields very broad in front, narrow and bent up on the sides, broader and arched over the hind legs, the post-vertebral shield large, as wide as long, third and fourth narrow, longer than broad; the fourth and fifth with an acute keel on the hinder edge; sternum rather broad; head very large, crown and temples covered with small shields, ears prominent, neck smooth; lower part of the outer edge of the hind leg with four larger plates, the last compressed and largest.

Hab. Brazils, Para.

There is an adult stuffed specimen, and a skeleton of nearly the same size, of this species in the British Museum collection.

This species is very like *H. gibba*, but the back is more depressed, the margin much wider, the head nearly double the size, compared with the size of the body, and the scales on the head are small, more numerous and more equal in size, and those on the edge of the hinder legs are larger and more equal in size.

Fam. 3. TRIONYCIDÆ.

CYCLANORBIS PETERSII.

Shell broad, rounded before and behind; sternal callosities five.

Hab. West Africa, River Gambia.

This genus was proposed by Dr. Peters, on his return from Mozambique, for a soft Tortoise which he discovered in that country, which has flaps to the sides of the sternum, covering the legs like the *Amydæ* of Asia, but differs from these in having no bones on the margin of the dorsal disk, which is soft and flexible as in the *Trionyces* with exposed legs.

This species from the Gambia appears to be distinct from the one noticed by Dr. Peters in Mozambique; I have therefore named it after that excellent naturalist, who has made such sacrifices for the extension of our knowledge of natural history, and of zoology in particular.

February 8, 1853.—John Gould, Esq., F.R.S., in the Chair.

DESCRIPTIONS OF SOME NEW SPECIES OF ENTOZOA FROM THE COLLECTION OF THE BRITISH MUSEUM.

BY W. BAIRD, M.D., F.L.S.

Class ENTOZOA. Order NEMATOIDEA.

Family ASCARIDÆ.

Genus ASCARIS.

1. ASCARIS SIMILIS.

Ascaris similis, Baird, Cat. Entoz. Brit. Mus. 19. t. 1. f. 1.

Head small; mouth with three small valves slightly projecting beyond the margin. Anterior portion of body much narrower than posterior. Tail rounded, thick, obtuse. Females spirally twisted in many convolutions; of a dark olive colour. Males straight to within a short distance of tail, which is inflected; of a whitish colour. Skin of body minutely and finely striated across. Wing extending along the whole length and becoming thicker and stronger at inferior extremity. Length of male 2 inches, breadth 1 line. Length of female 1¼ inch, breadth ¾ of a line.

This species resembles the *A. osculata* from the *Phoca vitulina*, but differs in having the wing stronger and thicker at inferior extremity, in having the head and mouth smaller, and in the skin of the body being finely striated across.

Hab. Stomach of a Seal from Antarctic Seas; collected during the late Antarctic expedition. Brit. Mus.

2. ASCARIS LÆVISSIMA.

Ascaris lævissima, Baird, Cat. Entoz. Brit. Mus. 25.

Head small, in form of a narrow circular rim, valves of mouth large and distinct, of a triangular shape, divided at the tip into two lobes, each of which again is broadly emarginate. Between each of the valves, at their base, is a small smooth tubercle or prominence. Body round, very smooth, of a rather dark olive colour, marked with numerous very fine smooth longitudinal lines, and occasional very distinct red circular lines at irregular distances; tapering at both extremities, narrower at posterior extremity. On each side of the body is a smooth narrow band of a lighter colour, which runs the whole length, and has the appearance at first sight of a wing, but is not raised. Length 10 inches; greatest breadth 4 lines.

Hab. ——? India; from the Collection of General Hardwicke. Brit. Mus.

3. ASCARIS BIFARIA.

Ascaris bifaria, Baird, Cat. Entoz. Brit. Mus. 26. t. 1. f. 2.

Head rather small, valves rounded, wrinkled transversely and slightly bifid at the upper margin. Body round, much narrower at anterior than posterior extremity. Anterior third of body surrounded with numerous very close-set, circular, raised striæ. Remainder of body smooth, with the striæ not raised and about one-fourth of a line apart from each other, till within about half an inch of inferior extremity, which is large and obtuse, when it again becomes surrounded with numerous raised circular lines or striæ which give it a wrinkled appearance. The tail terminates in a papilla, and the anus is lunar-shaped and situate at the base of the papilla about half a line from the extremity. The whole surface, in addition to the raised lines or striæ, is covered with exceedingly fine and immensely numerous striæ. A line runs down each side of the body throughout its whole length. Length 9 inches, breadth 5 lines.

Hab. ——? From Korea. Collected by Capt. Sir E. Belcher, C.B. Brit. Mus.

Family Gordiidæ.

Genus Mermis.

1. **Mermis spiralis.**

Mermis spiralis, Baird, Cat. Entoz. Brit. Mus. 35. t. 1. f 3.

About 7 inches in length and ⅕ mill. in breadth; of a red colour, rigid and twisted into many spiral convolutions. Anterior and posterior extremities obtuse. Body of equal size throughout and quite smooth.

Hab. Abdomen of a species of Grasshopper from Rio Janeiro. Brit. Mus.

2. **Mermis rigidus.**

Mermis rigidus, Baird, Cat. Entoz. Brit. Mus. 35.

Body of a light amber colour, smooth and very shining, narrow at upper extremity, very soon becoming thicker and terminating at inferior extremity in an obtusely conical point. The animal is very rigid and stiff throughout its whole length. Length 10¼ inches, breadth about ¼ a line.

Hab. ——? Coll. Brit. Mus

Genus Gordius

A. Body smooth

1. **Gordius platyura.**

Gordius platyura, Baird, Cat. Entoz. Brit. Mus. 36. t. 1. f. 4.

Body of a uniform dull white colour, quite smooth, with a depressed line on one side throughout its whole length, obscurely ringed at unequal distances, narrower at anterior extremity and terminating in a broad flattish tail, which is slightly bifid. Length of animal 32 inches, breadth of middle portion of body about ½ a line; tail 1 line broad.

Hab. Jamaica? From the Collection of Sir Hans Sloane. Brit. Mus.

B. Epidermis granulated.

2. **Gordius verrucosus.**

Gordius verrucosus, Baird, Cat. Entoz. Brit. Mus. 36. t. 1. f. 5.

Body black, covered all over with innumerable small, raised warty papillæ, round and very stiff like a piece of wire. An impressed line runs on each side through the whole length. Head small. Anterior extremity narrower than posterior Length 6 inches, breadth about ⅙ a line.

Hab. S. Africa? (Male.) From the Collection of Dr. A. Smith. Brit. Mus.

3. **Gordius violaceus.**

Gordius violaceus, Baird, Cat. Entoz. Brit. Mus. 36.

Body of a dark brown colour, apparently smooth, but under a high magnifying power completely covered with small flattish-looking papillæ, and ringed transversely with very slightly raised circular lines, about one-half or one-third of a millimetre apart from each other; tapering slightly at upper extremity, and gradually becoming thicker at inferior. Along the whole length of the body, on each side, runs a pretty deep sulcus or groove, interrupting the circular lines. Length 11 inches 3 lines, breadth about ½ a line.

Hab. Abdomen of *Carabus violaceus* from Berwickshire. Brit. Mus.

4. Gordius pustulosus

Gordius pustulosus, Baird, Cat. Entoz. Brit. Mus. 37.

Body of a light brown colour, not ringed across, completely covered with minute flattish-looking papillæ, and numerous larger raised dots or small warty protuberances intermixed, tapering considerably at superior extremity, and becoming gradually thicker towards the tail, which is obtuse and marked across with a deep indentation. Along the whole length of the body runs a deep groove on one side only. Length 8¼ inches, breadth ½ mill.

Hab. Abdomen of *Blaps obtusa*, from the neighbourhood of London. Brit. Mus.

When brought to the Museum it had just emerged from the *Blaps*, and was then 4 inches long and about the diameter of a horse-hair. It was placed in water and kept alive for a day or two, at the end of which time it had grown to double its original size, in both length and diameter.

5. Gordius sphærura.

Gordius sphærura, Baird, Cat. Entoz. Brit. Mus. 112.

Male: nearly black, quite smooth, flattened throughout its whole length, and nearly of equal size throughout. Length 16 inches, breadth ½ a line.

Female: of a dark brown, smooth, but rather deeply notched across, the notched lines occurring now on one side, now on another, but never going quite round the body, and at times presenting an appearance as if it were divided into numerous segments. The body is of nearly equal size throughout its length till it reaches the tail, which is somewhat swollen and club-shaped. Length 14 inches, breadth about ½ line.

Hab. Khasyan Hills, India. Collected by Dr. Joseph Hooker. Brit. Mus.

6. Gordius fasciatus.

Body smooth, skin prettily shagreened with very fine lines crossing each other in opposite directions, of a light colour banded with broad patches of dark brown. Anterior extremity smaller than posterior, and roughened with raised circular ridges, which extend for about three lines, and as well as posterior extremity of a very dark colour, almost black. Length 11¼ inches, breadth about 1 millimetre.

Only one specimen ♀.

Hab. N. America. Brit. Mus.

Order ACANTHOTHECA.

Genus PENTASTOMA.

1. PENTASTOMA MEGACEPHALUM.

Pentastoma megacephalum, Baird, Cat. Entoz. Brit. Mus. 39. t. 2 f. 1.

Female: body yellowish white, somewhat depressed and terminating anteriorly in a large, thick, club-shaped head. The dorsal surface is depressed at the edges, rounded and very prominent in the centre and transversely ridged. The ventral surface is more flattened, ridged and wrinkled; with the mouth in a hollow depression, surrounded by four strong, brown, simple hooks. The part of the body immediately beneath the head is very strongly ridged transversely, each of the first six ridges being wavedly wrinkled. The length of the whole body is about 11 lines. The head is 5 lines broad, and the middle portion of the body about 3½ lines, diminishing in size towards the tail. The oviduct is very long, the portion outside the body being 2 inches in length.

Male? Longer than female, about 14 lines long; covered with a smooth skin which is slightly ridged across, and has at its inferior extremity a small sharp papilla, about ¾ of a line in length and brown at the tip (the penis?). The inferior extremity is rounder than in the female, but otherwise the form of the animal is nearly the same.

Hab. Imbedded in the flesh of the head of a Soonderbund Crocodile, *Crocodilus palustris*, from India. Brit. Mus.

2. PENTASTOMA ANNULATUM.

Pentastoma annulatum, Baird, Cat. Entoz. Brit. Mus. 113.

Body white, elongate-cylindrical, nearly of the same size at each extremity, strongly ringed; rings raised, about twenty-eight in number, one line distant from each other. A dark blue line runs through the whole length of body on one side. Circumference of body 5 lines, length of body 2¼ inches.

Hab. In the lungs of the Egyptian Cobra, *Naja Haje*. Collection of Dr. Crisp.

Order TREMATODA.

Genus DISTOMA.

1. DISTOMA MICROCEPHALUM.

Distoma microcephalum, Baird, Cat. Entoz. Brit. Mus. 58. t. 2. f. 2.

Body of an elongated oval or lanceolate shape, of a slightly yellowish white colour, plicated transversely, the folds being very fine; head narrow, obtuse, separated from the body by a contraction; posterior extremity obtusely lanceolate; dorsal surface slightly convex; ventral surface nearly flat or somewhat concave; anterior sucker small, terminal; ventral sucker larger, round, prominent, surrounded by an elevated thickened edge, and situated within 3 millimetres of the former; organs of generation placed half-way between the two suckers in the form of an elevated papilla. Length from 6 to 8 lines, greatest breadth 1½ line.

Hab. Stomach of the Spinous Shark, *Acanthias vulgaris*, from Falmouth Harbour. Brit. Mus.

Order CESTOIDEA.

Genus TETRARHYNCHUS.

1. TETRARHYNCHUS RUGOSUS.

Tetrarhynchus rugosus, Baird, Cat. Entoz. Brit Mus. 69, t. 2. f. 3.

Body flattish, thick, exceedingly rugose, almost tuberculated, the rugæ extending right across the body, which is of a white colour. Head conical, thicker than the body and about one-fifth the length of it. Bothria inversely heart-shaped (the broader part being at the lower margin), deep, divided at the bottom by a narrow septum, edges thick and raised. Proboscides round and club-shaped at their tips. Inferior extremity of body, as it were, truncate. Total length (in spirits) 10½ lines, breadth of head 2½ lines, of lower part of body 3 lines, bothria 2 lines in length.

In one specimen the head is much broader than the inferior extremity of the body, being about 3 lines broad, while the inferior extremity is only 2 lines and is terminated by a heart-shaped appendage of about 1½ line long and of a light rose colour (the male?).

Hab. Taken alive from the lower intestine of a salmon. Brit. Mus.

2. TETRARHYNCHUS STRANGULATUS.

Tetrarhynchus strangulatus, Baird, Cat. Entoz. Brit. Mus. 69, tab. 2. f. 4.

Body flat, of a light yellowish colour, thickish, elegantly and minutely striated across and marked with slight longitudinal sulci, which run the whole length of the body. The head is narrower than the portion of the body which immediately succeeds it, is about 4 lines in length, longitudinally sulcated on the sides, smooth on the two faces, and distinctly separated from the body by a contraction which gives the appearance, as it were, of a shoulder to the commencement of the body. The bothria are shallow, oval-shaped and divided at the bottom by a septum, which, at about the half of its length, divides into two portions; the edges are raised and thickened. Proboscides short and stout; the inferior part of the body terminates in a blunt conical papilla. Length from 1½ to 2¾ inches; breadth from 2 to 3½ lines.

Hab. ——? From Chusan. Brit. Mus.

Genus TÆNIA.

1. TÆNIA BREMSERI.

Tænia Bremseri, Baird, Cat. Entoz. Brit. Mus. 73, t. 2. f. 5.

Head of a moderate size, surrounded with a double crown composed of upwards of twenty small hooks; neck very short. Articulations of body numerous, at first very small and nearly oblong, gradually enlarging in size as they descend, and becoming campanulate. They are marked with numerous fine transverse lines, which again are crossed by several strong longitudinal lines or grooves. The inferior angles of each joint are slightly prolonged into a point, and the margin is somewhat thickened (especially in the lower joints of body) and undulately waved or slightly scalloped. Orifices of ovaries irregularly alternate. Length of specimens about 7 inches, greatest breadth about 2½ lines.

Hab. In the Crocodile of the Soonderbund, *Crocodilus palustris*, from Bengal. Brit. Mus.

2. TÆNIA CALVA.

Tænia calva, Baird, Cat. Entoz Brit Mus. 83.

Head small, rounded and smooth, white and shining. Mouth unarmed. Neck constricted. Articulations of body at first very small, gradually enlarging in breadth as they descend till they reach about the middle of the body, where they are still narrow, linear-shaped and about seven times broader than long. After this they begin to increase in length and diminish in breadth, becoming at first nearly square, and at last, near the extremity, nearly twice as long as broad. All the articulations are strongly striated across, and the upper and lower margins, where they join with each other, are considerably thickened. Length 5½ inches, greatest breadth 3½ lines, breadth of lower extremity 1 millimetre, of head ⅙th of a mill.

Hab. Intestines of the common Grouse, *Lagopus Scoticus*. Brit. Mus.

3. TÆNIA GOEZII.

Tænia Goezii, Baird, Cat. Entoz. Brit. Mus. 78.

Articulations of body very short and numerous. Inferior margins straight. Genital orifices opposite, situated on or near the lower edge of each joint, the lemniscus projected out in form of an elevated papilla which curves downwards. Unfortunately the head is wanting. Greatest breadth of body 6 lines, length of articulations about ½ a line.

This species differs from *T. expansa* and *denticulata* (to which species it approaches) in having the posterior or inferior border or edge of each articulation smooth and rounded, instead of being crenulated or undulated; and in having the genital orifices situated on the lower edge of the articulation, instead of in the middle.

Hab. ——? Brit. Mus.

4. TÆNIA ZEDERI.

Tænia Zederi, Baird, Cat. Entoz Brit. Mus. 85.

Articulations of body of moderate size, campanulate-shaped, lower margins of each more or less crenated and thickened; at first they are short, they then become longer and narrower as they descend. The greatest breadth is about 2 lines. The whole body is of a yellowish-white colour. Unfortunately the specimens are imperfect at the upper extremity and want the head. The orifices of the genital organs are irregularly alternate.

Hab. Stomach of a Penguin from the Antarctic Seas. Collected during the late Antarctic expedition. Brit. Mus.

5. TÆNIA FALCIFORMIS.

Tænia falciformis, Baird, Cat. Entoz. Brit. Mus. 116.

Head conical, proboscis unarmed?; suckers large, oval-shaped; no neck, body at anterior extremity very narrow, almost linear, gradually enlarging as it descends, articulations very numerous, extremely narrow. The body is flat and is curved like a sickle. Genital orifices ——? Length about 2¼ inches, breadth at broadest part 1 line.

Hab. ——? Collected during the Euphrates expedition. Brit. Mus.

Genus BOTHRIOCEPHALUS.

1. BOTHRIOCEPHALUS ANTARCTICUS.

Bothriocephalus antarcticus, Baird, Cat. Entoz. Brit. Mus. 90.

Head conical, elongated, smooth, with two lateral opposite fossettes. At the lower margin of each fossette there are two small rounded projecting lobes. Body rounded, from the neck some way downwards it is quite round or cylindrical, and the articulations are very numerous and very small, appearing like mere ridges across. Lower down, the body becomes flatter and the joints larger and more developed, lower margin thin. An impressed line runs along the centre of the body through its whole length. Length about 9 inches, greatest breadth of body about 3 lines.

Hab. In the stomach and intestines of a Seal caught about and within the Antarctic Circle. Collected during the late Antarctic Expedition. Brit. Mus.

MISCELLANEOUS.

Note on the Reproduction of Ligula. By M. BRULLÉ.

M. BRULLÉ has made a communication to the Academy of Sciences of Paris, stating that he has found a new mode of reproduction to prevail in a species of *Ligula*, which infested the Bleak (*Cyprinus alburnus*) in the Canal of Burgundy, in great numbers during the past summer. The *Ligulæ* have generally been regarded as Cestoid worms which passed a first, asexual stage of development in the interior of the bodies of freshwater fishes, and only acquired reproductive organs when they reached the intestines of birds. According to M. Brullé's statement, it appears that the *Ligulæ*, contrary to the generally received opinion, are capable of producing living, Cercariform young whilst still parasitic upon fishes; he saw one of these worms which he had just extracted from the body of a Bleak, produce two or three young ones, which, he adds, "resembled the parent, except that the anterior portion of their body was broader and thicker than the opposite extremity. They may be compared, except in size, with the spermatozoa of man." This observation was made about the end of August, and although this was the only time that M. Brullé actually saw the emission of the Cercariform young, he noticed that at that period all the *Ligulæ* which he placed in water were soon accompanied by a similar progeny. After the middle of September the young were always found in company with their parents in the abdominal cavity of the Bleak*.—*Comptes Rendus*, October 23, 1854, p. 773.

Description of the Animal of Cyclina sinensis. By Dr. John Edward Gray, F.R.S., V.P.Z.S.

The description of this animal was written some ten or twelve years ago, from a specimen kindly given to me by Mr. John Reeves, to whom we are indebted for the knowledge of the greater part of the animals of China and Japan now known to zoologists.

The animal in most particulars agrees with that of the genus *Dosinia*, next to which I proposed to place it, in my paper on the arrangement of the genera of *Veneridæ*, published in the 'Annals and Magazine of Natural History' for January 1853.

M. Deshayes regards *Venus Chinensis* as the type of the genus *Cyclina*. In his late monograph he has united to this genus the *Lucinopsis* of Messrs. Forbes and Hanley, but the description of the animal here given will show that *Lucinopsis* is a very distinct genus, for it has separate siphons, whilst the type of the genus has the siphons united as in the other *Dosiniana*. It differs from *Dosinia* in the absence of the anterior lateral tooth

Cyclina sinensis.

Mantle lobes free the whole length of the lower margin, the lobes then with a series of radiating muscular bands, a little within the edge; united together behind and extended into a compressed, rather slender, elongated siphon, grooved along the centre of each side and ending with two apertures, the retractor muscles of the siphons angular; the foot (in spirits) rhombic, very much compressed, inferior, subcentral, the lower angle rather produced in front; the lips equal, very long, slender, triangular, more than half the length of the foot; the gills large, oblong, elongate, equal.

The crenated margins of the valves of the shell are covered with the inflexed edge of the hard periostraca; the siphonal inflection is angular.—*Proc. Zool. Soc.* Feb 8, 1853.

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* M. Brullé considers that in the present state of the question, we must suppose that the *Ligulæ* present "two modes of reproduction, one viviparous, during what has been regarded as their larva state; the other, oviparous, when they have arrived at their perfect state" From his observations it appears rather that the form of *Ligula* inhabiting the fish is very analogous to the well-known germ-sacs of many of the Trematode worms, so that it is probably one of a series of phases of development such as we find in the so-called alternation of generations.—Ed. *Annals*.

Observations on the Development of Actinia.

By M Lacaze-Duthiers.

The author did not observe the deposition of the ova; all the embryos were furnished with cilia, and consisted of an inner, granular coloured part, and an external layer. It is in the former alone that the changes take place. The embryo is oval, or spherical, and moves rapidly by turning in any direction

The first change is a sort of indentation which soon produces a cavity. The central mass is then divided into two unequal masses, by two constrictions which proceed from the circumference to the central cavity, and at this period the orifice of the cavity becomes elongated, its extremities corresponding with the middle of each of the two parts. The inequality of this first division is followed by a similar irregularity in the following subdivisions until twelve are produced.

The largest of the two parts first divides into three, when the embryo presents four lobes. The smaller portion then divides into three, and six divisions are formed. The two lobes of the larger portion nearest to the small one afterwards divide into two, forming eight lobes; the extremities of the mouth always corresponding with the median lobes of the two original divisions, which now contain, the one five, the other, three subdivisions. The two lobes of the larger portion nearest to the original constriction now divide into two, and the two new lobes are again halved, until the whole consists of twelve divisions.

At this period the young *Actinia* is very contractile, and often changes its form; it moves in every direction, but always keeps the mouth in front. The lobes then become nearly equal, and the tentacles begin to make their appearance. They appear at first as tubercles, to the number of six, each corresponding with the cavity of a lobe. The two first are situated at the two extremities of the mouth at the middle of the two original portions. Before the six first tentacles have acquired any great development, six other tubercles make their appearance between them, forming the second circle.

From this moment the mode of multiplication changes; a new tentacle is developed between each pair, so that the third circle has twelve, the fourth twenty-four, the fifth forty-eight, the sixth ninety-six, &c. The multiplication of the cells always precedes that of the tentacles, which are only to be regarded as their external appendages. Their increase takes place in the following manner:—At the middle of the last-formed cell, a partition or constriction is seen, which at first appears simple, but soon becomes double, and the laminæ of which bound three cells—two lateral and one central, the latter corresponding with the old cell, which is thus separated from those with which it was previously contiguous by two new cells produced at its expense. The consequence of this mode of development is that each cell *has two partitions*, but that the last cycle is always formed of compartments without proper lateral walls, for those which bound them belong on the one side to a cell of a certain age, on the other to a cell of the preceding cycle.

The fact is proved by the development of the intestiniform masses borne by the free margins of the partitions in the ventral cavity. The six first pairs of bundles are developed on the twelve partitions, which bound the six primitive cells, corresponding to the six first tentacles; six other pairs are then developed upon the twelve dissepiments of the six cells of the second cycle; and afterwards twelve pairs appear on the twenty-four partitions of the third cycle. It is easy to see that the nearer the bundles approach the centre, the older they are.

All the work of division appears to go on in the central portion of the embryo, whilst the envelope, which forms a regular cutaneous layer, is gradually enlarged without taking any part in the formation of the partitions.—*Comptes Rendus*, August 28, 1854, p. 431.

METEOROLOGICAL OBSERVATIONS FOR NOV. 1854.

Chiswick.—November 1. Dense fog: very fine. 2. Foggy: hazy: very fine. 3. Fine: clear. 4. Overcast: fine. 5. Cloudy. 6. Clear and very fine. 7. Foggy: cloudy. 8. Overcast: fine. 9. Clear and cold: sharp frost: rain. 10. Fine, but cold: rain. 11. Slight rain: cloudy: fine. 12. Fine: frosty at night. 13. Foggy: fine. 14. Densely clouded: heavy rain. 15. Heavy rain: fine: rain. 16. Rain: foggy at night. 17. Foggy: rain: overcast. 18. Densely overcast and windy. 19. Overcast: clear and cold. 20. Cloudy: clear and cold: fine. 21. Overcast. 22. Clear: densely clouded: clear. 23. Fine: cloudy: sharp frost. 24, 25. Cloudy and cold. 26. Clear: overcast. 27. Foggy. 28. Overcast: rain. 29. Cloudy and fine. 30. Clear: rain at night.

Mean temperature of the month .... 39°·35
Mean temperature of Nov. 1853 .... 40 ·14
Mean temperature of Nov. for the last twenty-eight years . . 43 ·07
Average amount of rain in Nov. .. . . 2·38 inches.

Boston.—Nov. 1. Fine. 2. Cloudy. 3. Fine. 4. Fine: rain P.M. 5. Cloudy. 6, 7. Fine. 8. Cloudy. 9. Fine: snow and rain A.M. and P.M. 10. Fine: rain P.M. 11. Fine. 12. Fine: rain P.M. 13. Cloudy. 14. Cloudy: rain A.M. 15, 16. Rain A.M. and P.M. 17. Rain A.M. 18. Cloudy: rain P.M. 19. Fine: rain A.M. and P.M. 20. Cloudy. 21. Cloudy: rain A.M. and P.M. 22, 23. Cloudy. 24, 25. Cloudy: rain A.M. and P.M. 26, 27. Fine. 28. Cloudy: rain P.M. 29. Fine: rain A.M. 30. Cloudy.

Sandwick Manse, Orkney.—Nov. 1. Showers A.M.: cloudy P.M. 2. Rain A.M.: clear P.M. 3. Bright A.M.: showers P.M. 4. Cloudy A.M.: rain P.M. 5. Cloudy A.M. and P.M. 6. Cloudy A.M.: showers P.M. 7. Showers A.M. and P.M. 8. Showers A.M.: snow-showers P.M. 9. Snow-showers A.M.: sleet-showers P.M. 10, 11. Cloudy A.M.: clear P.M. 12, 13. Cloudy A.M. and P.M. 14. Cloudy A.M.: cloudy, drops P.M. 15. Showers A.M. and P.M. 16. Showers A.M.: rain P.M. 17. Drizzle A.M.: damp P.M. 18. Fine, cloudy A.M.: showers P.M. 19. Fine, cloudy A.M.: clear P.M. 20. Damp A.M.: showers P.M. 21. Showers A.M. and P.M. 22. Rain A.M.: showers, aurora P.M. 23. Clear, frost A.M.: snow-showers, frost P.M. 24. Snow A.M. and P.M. 25. Snow, thaw A.M.: thaw, rain P.M. 26. Fog A.M.: cloudy P.M. 27. Cloudy A.M.: showers, sleet P.M. 28. Showers A.M. and P.M. 29. Showers A.M.: sleet-showers P.M. 30. Clear A.M.: sleet-showers P.M.

Mean temperature of Nov. for twenty-seven previous years . 42°·67
Mean temperature of this month ... . 42 ·05
Mean temperature of Nov. 1853 . ... 44 ·87
Average quantity of rain in Nov. for thirteen previous years 4·25 inches.

Meteorological Observations made by Mr. Thompson *at the Garden of the Horticultural Society at* CHISWICK, *near London;* *by* Mr. Veall, *at* BOSTON; *and by the* Rev. C. Clouston, *at Sandwick Manse,* ORKNEY.

Days of Month.	Barometer.					Thermometer.					Wind.			Rain.		
	Chiswick.		Boston 8¾ a.m.	Orkney, Sandwick.		Chiswick.		Boston 8¾ a.m.	Orkney, Sandwick		Chiswick, 1 p.m.	Boston.	Orkney, Sandwick.	Chiswick.	Boston.	Orkney, Sandwick.
1854 Nov.	Max.	Min.		9¼ a.m.	8½ p.m.	Max.	Min.		9¼ a.m.	8½ p.m.						
1.	30·361	30·352	29·90	29·74	29·90	61	32	40	53½	52½	sw.	s.	s.	...	·12	·03
2.	30·424	30·161	29·90	29·90	29·86	59	39	49	47½	45	se.	sw.	wnw	...	...	30
3.	30·265	30·215	29·77	30·04	30·08	52	25	40	42½	40	n.	nw.	nw.	...		·18
○ 4.	30·197	29·992	29·75	29·94	29·78	53	49	41	46½	49½	w.	nw.	wnw.	...	.	·05
5.	30·144	29·982	29·50	29·82	30·02	57	29	53	48	48	nw	wnw.	wnw	..	07	·17
6.	30·359	30·301	29·92	30·16	30·19	53	25	36	48½	50	n	nw.	nw.	...	...	...
7.	30·501	30·421	30·07	30·13	29·91	51	26	33	51	51	w.	nw	w.	...	...	04
8.	30·278	30·164	29·80	29·94	30·16	51	31	42	41	34	w.	wsw	w	·01	...	63
9.	30·246	30·156	29·86	30·23	30·02	44	18	33·5	38	41½	n	nw	wnw.	04	...	·19
10.	30·209	30·002	29·78	29·98	29·92	50	41	34	40½	37	w.	nw.	n.	·01	·09	·05
11.	30·126	29·994	29·66	30·10	30·20	49	28	41	37½	38	ne.	nw.	nnw.	·03	·18	...
☾ 12.	30·228	30·219	29·88	30·14	29·96	47	21	39	41½	44½	w.	nw	ssw.	...	...	...
13.	30·088	29·828	29·70	29·71	29·58	51	36	35	44½	46	s.	s.	sse.	...	·02	...
14.	29·598	29·471	29·30	29·46	29·44	45	29	39	47	45	se.	s.	s.	·09	...	...
15.	29·116	29·056	28·87	29·38	29·42	53	30	40	43	41	sw.	se.	sse.	34	·08	·16
16.	29·207	28·965	28·72	29·52	29·56	49	29	45	41½	42⅔	sw.	e.	e.	02	·29	·13
17.	29·407	29·331	29·07	29·73	29·96	49	39	45	44½	42	ne.	ese.	se.	·08	·19	·38
18.	29·828	29·621	29·40	30·07	30·18	44	36	43	39	41	ne.	ne.	ne.	...	04	·02
19.	30·084	29·993	29·74	30·26	30·31	44	32	39	41½	40	nw.	ne.	n.	...	·03	02
● 20.	30·122	30·018	29·84	30·12	29·70	42	32	40	44	45	ne.	n.	nw.	...	·09	·02
21.	29·876	29·175	29·38	29·34	29·22	44	26	38	43	36½	sw	ssw.	n	·17	...	·14
22.	28·975	28·924	28·65	29·08	29·42	43	26	34	40	37½	w.	nw	e.	...	·26	·41
23.	29·061	29·057	28·88	29·46	29·52	42	23	36	34	33	ne.	n	ne.	...	...	·20
24.	29·266	29·186	28·98	29·60	29·72	42	30	36	33	33	ne.	n.	e.	...	·10	·05
25	29·487	29·130	29·20	29·76	29·73	40	26	35	37½	39½	n.	nnw.	w.	...	·16	17
26.	29·942	29·302	29·57	29·77	29·71	39	28	30	37½	44	ne.	w.	w.	...	·07	·31
☽ 27.	29·932	29·797	29·60	29·38	29·12	34	29	27·5	44	42	sw.	n.	w.	...	...	·02
28.	29·702	29·371	29·33	29·23	28·66	49	42	39	40½	46	sw.	w.	w.	·24	...	·41
29.	29·199	28·990	28·63	28·52	28·96	50	29	43	39	34	w.	w.	wnw.	·06	·05	·64
30.	29·516	29·123	29·14	29·01	28·86	51	37	37	39½	35	w.	nw.	wnw.	·22	07	·10
Mean.	29·858	29·676	29·46	29·717	29·702	47·93	30·77	38·8	42·30	41·80				1·31	1·91	4·82

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VII.—*Some Account of the* Actiniadæ *found upon the Coast near Teignmouth, Devon.* By ROBERT C. R. JORDAN, M.B. Lond., Med. Tutor and Professor of Comparative Anatomy, Queen's Coll. Birmingham.

DURING the month of April of the present year (1854), aided by other members of my family, I undertook to investigate the various species of *Actiniæ* and the allied genera found upon the coast near Teignmouth. Although several kinds were already known to us by sight, we were fortunate enough to find more species than we had anticipated. The part of the coast examined extended from the small rocks between the beach at Dawlish and the Warren on the one side, to the rocks bounding the Torre Abbey Sands on the other. This includes rather more than ten miles of the coast. The actual localities explored within this district were but few, and none of these could be looked upon as exhausted; indeed it would not surprise me in the least to find at a future visit fresh species even in those very portions of the coast to which we have given the most attention. The hunting grounds were formed, in all except one place, by masses of red sandstone, which, detached at some former time from the cliffs above, are now overgrown with Fuci, and submerged at high water; some, indeed, being only exposed to the air in a low spring tide. In the single exception to this, the rocks on the Meadfoot Sands near Torquay, the only difference was the substitution of masses of limestone for the red sandstone of the other localities.

The first species I shall notice is the very common *Actinia Mesembryanthemum*. The division of the genus *Actinia* into two groups, in one of which the skin is smooth, and in the other studded with porous warts, is useful in determining the various kinds; it will therefore be adopted in the following sketch.

ACTINIA.

Div. I. *Skin smooth.*

α Conspicuous tubercles on the margin of the oral disc.

1. *A. Mesembryanthemum.*

Abundant in every locality examined. Though specimens may be found of almost every shade of colour, there are yet three marked varieties which admit of description. The first (var. *α.*) is when full-grown much larger than either of the other two: the example figured by Dr. Johnston as the largest ever seen by Mr. Cocks is by no means of unusual size. The ground colour is of a rich red, which is thickly studded with spots of a lively emerald-green. The oral tubercles are bright blue, and the disc is encircled with a narrow line of the same colour. The tentacles are red, generally slightly paler than the body. The second variety (var. *β.*) is, with the exception of the tubercles and the blue line around the disc, of a uniform red, and the third (var. *γ*) is, with the same exceptions, of an olive-green colour.

This Anemone serves well to prove that colour alone must not be taken as a guide to the determination of species amongst the *Actiniæ*. We met with some striped with green or blue, others entirely of a pale lilac, of an emerald-green, or even of a blue colour, whilst some are of so dark a red as to be almost black. The most marked of these varieties were found on the Shaldon side of the river Teign, rather further on than the Ness Rock. The paler specimens were on the under surface of stones, and were probably etiolated for want of light.

On the rocks by the "Breakwater" at Teignmouth, we found a double monstrosity of this species, two Anemones but only one disc. This is not rare amongst the *Actiniæ*

This species is hardy enough to bear almost any treatment. Some which we have long had in our possession have more than once given birth to young; these are extruded by the mouth. The very young *Actiniæ* differ in their lighter colour, and in possessing a far less number of tentacles, which are also of greater proportionate length. The tubercles also are not conspicuous in the very young. Some have been sprinkled with green even at birth. This species can scarcely be confounded with any other. It expands freely, but perhaps more in the daytime than the night. It is sluggish in habit, but occasionally moves by elongating the disc in the direction towards which it is advancing. In contraction it never becomes much adpressed, but always retains somewhat of a conical form. Its body sometimes swells out by imbibition, so as to become semitransparent; this is probably more the effect of some change in the specific gravity of the water, than through the power of the animal. It generally happens if fresh water be added. When so swollen out, the septa between the chambers are plainly visible from beneath.

β. *Without conspicuous tubercles.*

2. *Actinia alba.*

A pretty and quiet little species, rare with us, or more probably not easily found from its lying so flat to the rocks when in a contracted state; and this is in itself enough to recognize it from *Troglodytes*, an abundant inhabitant of every rock-pool. The specimen of *A. alba* from which the following description was taken, had been in our possession more than a year, during which time it had never moved in the slightest degree. Wishing to prop up an injured specimen of another species, the hollow niche of the stone which formed its home was partially filled up with fine sand. This annoyed the hitherto stationary Anemone, and it at once began to take a walking tour, moving along with tolerable rapidity by the usual mode of progression, namely the elongation of the disc. Any other mode of locomotion is undoubtedly rare amongst the *Actiniæ*. It was long before the poor little Anemone could settle down to its former life, or find a comfortable resting-place. It seldom even expands except at night. During the time in which it has remained with us, it has not apparently increased in size at all. When laid flatly on the rock as in contraction it is not quite half an inch in diameter, and when expanded it does not measure as much as this, even including the tentacles in the admeasurement. It generally lies perfectly flat upon the surface of the stone, like a thin gelatinous crust; in its thickest part only raised about a line from the rock. It is then of an oval form, and the aperture at the oral disc not round, but linear; it is of a cream colour, with about twelve whiter lines stretching from the centre to the circumference; between these are other lines, but not so broad and not extending the whole way. The first lines probably indicate the divisions of the ovarian chambers. When expanded it becomes very pretty, its body is cylindrical, and from the summit radiate the tentacles, forming a most beautiful circlet something like a daisy. The tentacles are filiform, in three or four rows, much more slender and proportionately shorter than in the next species. Their colour is white, with three narrow dark rings. Within the tentacles is a circle of yellow, and inside this again a white ring surrounding the mouth, which rarely expands so fully as to be quite round. Our specimen certainly did not possess "the three rows of minute white tubercles on the oral disc externally," as described by Mr. Cocks.

It was found not very far from high water mark, but completely buried beneath the sand.

3. *A. Troglodytes.*

Very abundant, and apparently found all along the coast; three or four may generally be seen in every rock-pool; its time of expansion is the light and sunshine. The tentacles and oral disc are the only parts usually visible, and these are seen studding the bottoms of the little shallow pools like stars; but if the Anemone be touched, it disappears entirely. Their bodies are either buried in the sand, or else hidden amongst the small mussels which coat the rocks. If taken off by a wedge and hammer carefully, so as to leave their base still fixed to the stone, they will live very well in confinement. It would be a slander upon those we have kept to say that they rarely expand, as they are generally fully open during the daytime; nor are they inactive, often shifting their position.

The body of this *Actinia* is gray, with sometimes a very slight tinge of olive, sometimes almost dirty-white; always marked with lighter longitudinal stripes, which radiate from the oral aperture to the disc. When contracted it assumes a beehive shape, but it has the power of becoming more flat than this.

In expansion, the ground colour of the part within the rays is white; the oral aperture either oval or round, with a narrow buff margin; outside this is a circlet of white dots (in those we counted, twelve in number); each of these has a dark border which makes them conspicuous. From these seemed to radiate the first row of tentacles, and from the interspaces a second and deeper row arise. Outside these dots is a white ring, broad and margined by another circlet of buff, bordered by a line of black, outside which is another broad ray of white, forming the base of the free portion of the tentacles. The remaining portion of these are of the same gray as the body, except that they are slightly lighter towards the tip. The markings do not always follow the exact pattern here given, but are subject to slight variety. The tentacles are thick in proportion to the size of the Anemone, and nearly equal the body in length.

In the description given by Dr. Johnston, the tentacles are said to be "in two not very regular circles;" they appear to me to be rather quadriserial; but (as pointed out by Holland in the 'Annales des Sciences') in any species of *Actinia* with numerous tentacula, they are often not exactly on the same plane, so that it is almost impossible to say how many rows they do form.

Thus *Troglodytes* might be said to have two series, the alternate ones being always on a lower plane; or it might be described as having four series. From this, and from the number of rows varying with age, this character seems to me of little value in the determination of species.

A large variety of this kind, or perhaps a distinct species, occurs sometimes, thrown upon the Teignmouth beach after storms. The body of the specimen from which the following description was taken is of a uniform gray colour, with a tinge of buff. It is twice the usual size of *Troglodytes*, and in contraction assumes the same hemispherical form, though the body is a little more elongated. In expansion it is cylindrical, but the form changes much, sometimes becoming much lengthened, and at others being constricted in the middle, so as to put on somewhat of an hour-glass shape. When expanded the mouth is seen to be surrounded by a circle of yellow, bounded by a dark line, and outside this is another yellow border, which is ended by a wavy irregular line of blackish-brown; this may be said to mark the commencement of the tentacles. Outside this waved line is a broader ring of black. If the appearance of these with regard to one tentacle be described, the broader line forms the base of two triangular figures, of which the waved line forms the sides, the angle subtending the base pointing towards the centre of the disc. Beyond this the tentacles are white, with three rings of grayish-brown, and tipped with the same colour at their summit. They are numerous, arranged in four rows, thick, and proportionately shorter than in the typical *Troglodytes*. Though the description and appearance of these two are very much alike, there is an indescribable difference between them, which makes me unwilling to regard them as certainly the same. The larger variety expands only in the dark, and is found thrown upon the beach after storms. Both these facts make me regard it as a denizen of the deep sea. No species of Anemone would be less likely to be thrown upon the shore than *Troglodytes*, which so readily retires under the sand for shelter.

A. Troglodytes has been supposed to be the young of *Actinia crassicornis*; that this is not the fact can easily be proved by keeping them. We have had some nearly two years, and they are still *Troglodytes*.

4. *A. aurantiaca*, mihi.

A. parvula; corpus aurantiacum, cylindricum, vel, si contractum sit, conicum. Tentacula coloris ejusdem, sed fusco tincta, filiformia, corpore longiora, serie quadruplici posita, prope basin striga alba cincta.

Clearly distinct as a species from any other met with by us, and also from any other described either by Dr. Johnston or Gosse: it seems the least of the Anemones. We only met with them in one locality, and this was upon a rock underneath the "Ness." They were found on the 11th of April 1854: a large mass of stone had fallen at some previous time from the cliffs above, and was so supported by others that its lower surface was free. This shelf was thickly studded with acorn shells and sponges. Amongst these were numerous examples of this little *Actinia*, hanging pendent from the rock, in shape much like a rain-drop ready to fall. Their tentacles were not expanded, but on touching them they contracted still more, and speedily shrank in amongst the *Balani*, and were lost sight of entirely. By aid of a wedge three or four examples were procured, some of which are still living. They are, as before said, small, and, when contracted, of a conical form, but in expansion their bodies are usually cylindrical, and of an orange or rather almost salmon colour. The tentacles, which are numerous, very fine, and considerably longer than the body, seem disposed in four rows; they are not quite of so bright a colour, having a grayish tinge blended with the orange; near the base they are marked with a cream-coloured or whitish bar, which looks, when the whole series of tentacles are taken together, like a lighter circle. When contracted into a cone, the *Actinia* is of a deep orange, with a central spot of a deeper tinge.

5. *Actinia*, n. sp.? *pulcherrima*, mihi.

This *Actinia* differs from the *A. rosea* of Gosse (p. 90, Devonshire Coast) chiefly in this, that the tentacles are not uniform in size and shape; however, I hope at some future time to examine the locality pointed out by him for *A. rosea*, and see if the two species be really distinct. In the mean time the following description will enable any one to recognize this Anemone, should it be again met with.

A. corpus cylindricum, album, et glabrum. Tentacula rosea, radiis quinque digesta, quatuor externis filiformibus, et tribus annulis fuscis vittatis, interno, tentacula duodecim crassiora habente, sed etiam rosea, et fusco variegata. Os album, striis fuscis ab eo divergentibus, inscriptum.

Found on the Warren near Dawlish (or rather amongst the rocks between the Warren and the Dawlish Beach). We met with only one example, in spite of a diligent search for more; it was found on the 28th of April. The disc was injured by the capture, yet it lived about six weeks in confinement, and then indeed died, with many others, from an accidental impurity of the sea-water. When found, it had everything but the tentacles completely buried beneath the sand. These did not then form a perfect circle, but were star-like in form, and looked more like a small plant of *Delesseria hypoglottis* radiating from a centre, than anything else, though they were less scarlet and more rosy in tint. At our first glance we mistook the *Actinia* for some seaweed of this kind. It was attached at some depth beneath the sand, and shrunk-in the moment it was touched. After some trouble we succeeded in getting it, but were much disappointed in finding a dull white Anemone, shaped like a beehive, and without any trace of the rosy tentacles which but a minute before had looked so lovely, in fact, we could scarcely feel certain that we had secured the prize, the change in its appearance seemed so magical; however, when placed in sea-water, it soon again spread its rosy crown of tentacles.

In contraction this Anemone is of a dull white, which has however a somewhat transparent look. There is no mark or line on the whole surface. It expanded sufficiently to enable its tentacles to be fully seen. They are short in proportion to the body, and of a bright crimson lake colour; they are in five rows; the four outer of these are fine, almost filiform, and of these rows the outermost seems the shortest, but this may be only from the incomplete expansion; each tentacle has three rings, as if a single shade of gray-brown was painted on the crimson ground; between these rings the colour is slightly lighter than elsewhere. Within these four rows of fine tentacles is another circlet of twelve, much thicker than the others, also rose-red shaded with brown, but almost conical in shape. The oral disc is white, with radiant dark lines.

It never completely expanded during its life in confinement, probably owing to the injury it had received. The tentacles were during this time always spread in a circular form, and it never put on the star-like shape which it had when first seen. The sun was then shining brightly into the pool in which it was found.

With this species ends my account of the first great group of the *Actiniæ*. We now pass to the second, or those provided with porous warts.

Div. II. *Skin more or less covered with porous warts.*

6. *Actinia parasitica.*

Very common indeed upon the shore after storms, and generally found attached to whelks. It is of large size, and assumes in contraction a beehive, or else a cylindrical form. The skin is almost leathery to the feel. The prevailing tint varies from a light yellowish to a deep purplish-brown, with yellow and red spots. It is darker at the base than towards the apex, the upper part of the Anemone being often of a straw colour; it has always about twelve broad longitudinal yellow bands running from the apex to the base; there are also narrow yellow stripes between these, running from the base and gradually losing themselves. The oral disc is white; the tentacles though not long are filiform, and very numerous, in five or six rows; they are white, with the exception of a line of darker spots on each side of the upper surface of the inner row. In some specimens I believe the spots extend to all the tentacles, or the tentacles may even be ringed with black. The most remarkable feature in this *Actinia* is the single circlet of large porous tubercles which surrounds the body, about one-third of an inch from the base. These are only seen when the animal is expanded; there is apparently one aperture for each ovarian chamber; they are slightly darker in tint, raised and perforated in the centre. It has the power of ejecting water from them, and thread-like filaments are often to be seen protruding from their orifices.

This Anemone inhabits the deep sea, and is only thrown up after stormy weather, when abundance of specimens are to be found: they do not live well in confinement. The figure in Dr. Johnston's work gives an excellent idea of this species, but I have searched in vain for the rows of small glands near the summit. The single ring of large glands near the base is omitted, but these are not always visible.

7. *Actinia clavata** (Thompson); var. *rosacea* (Gosse).

This specimen was taken from a hole in one of the sand masses formed by *Sabellæ*, amid the rocks beneath Torre Abbey. It had no sand adhering to it, and was taken without injury and remained for a long time in excellent health. Its base is of a reddish-orange colour, thickly punctured with fine red spots; this shades off into a much lighter colour towards the mouth, where the ground is of a straw colour, but here there are distinct rows of brilliant red spots, some of which even extend up the under surface of the tentacles; these are probably porous. When the Anemone is contracted, it is of a semiglobose form, and the colour is then more intense than in expansion, but the tint is always darker at the base than towards the upper portion of the body. In expansion it becomes very much longer, but the base is always the broadest part, and never under any circumstances does it assume the pedunculated form of *Actinia bellis.* In addition to the distinct rows of red spots there is another remarkable feature in this *Actinia*: the margin of the body at the oral disc does not end, as in most Anemones, in a smooth circle, but in a waved or crenate margin, and the rows of spots before described correspond to each crenature, one commencing at every salient fold. When expanded, the crenation of the margin is especially remarkable, so that it assumes the appearance of an external row of minute tentacles. The upper portion of the body then becomes of a pearly white, with a transparent glass-like look, the red spots being still very conspicuous; between each of these is a distinct line, but indicated rather by an indentation and consequent depth of shade, than by any actual change in the colour. When the Anemone is only in part expanded, the numerous tentacles are very much folded over each other, so as to give the appearance of two or three rows; yet when wholly spread, though never forming a circle, but always having some curiously waved outline, they are clearly seen to be disposed only in one row. The tentacles are large, and white in colour with a delicate shade of pink, they are also transparent; but their chief peculiarity is their long taper form, and in addition to this their being webbed or united at the base, so much that when fully spread their point of union extends beyond the margin of the disc. In complete expansion, as before said, the crenate margin of this superior disc much resembles an exterior row of small tentacles. The disc itself is white, except that around the mouth is a delicately waved pink line or border.

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* Kindly named, from the description given above, by Mr. Gosse, to whom the account was referred.

8. *Actinia coriacea.*

Met with in the two varieties of *A. coriacea* and *A. crassicornis*, in every place examined by us. It varies much in colour; the body may be of a rich dark red with white tubercles, or of a light pale green or even almost white. These Anemones are always found near low water mark, and though nothing can exceed their gorgeous appearance when fully expanded, there is yet something almost forbidding in their aspect. They do not live well in confinement, at least as far as our experience goes, nor do they afford much of interest. The coating of shells and sand is under these circumstances speedily thrown off.

9. *Actinia dianthus.*

This may also be dismissed briefly. It is only known to us as thrown upon the Teignmouth beach rather frequently during the storms of winter. The colour of the body varies in these examples from light orange to cream colour. The description of the species in Dr. Johnston's work is very good, and the figure in the Rev. Dr. Landsborough's little popular work on 'Zoophytes' is very faithful. It is a lovely species and can scarcely be confounded with any other kind.

At the time of making these investigations we had not seen Mr. Gosse's interesting 'Rambles on the Devonshire Coast,' but under its guidance we may hope to find several other species, since he has met with them (as for example *Actinia bellis, A. anguicoma, A. rosea* (Gosse), and *A. nivea* (Gosse)) within the boundaries of coast here mentioned. There are also scattered in my note-book legends of other species of the genus, which it is to be hoped may some day ripen into certainties, but these are the only *Actiniæ* of which I can at present give a detailed description. Of other *Actiniadæ* the only kind we have found on the coast is,—

10. *Anthea Cereus*,

which is far from rare. We have once met with it in a sand-pool beyond the rocks at Teignmouth, and also on the sands below Torre Abbey, but its chief haunt is in the pools amid the rocks which separate the Dawlish beach from that of the Warren. It seems to be very gregarious in its habits, many always being found in the same pool.

It is a very lively and pleasant Anemone to keep, moving about with much activity, but always, as far as we have seen, by aid of the disc only. They often make the entire tour of their prison-house, and it is to be feared that sometimes these expeditions are of an aggressive character, for more than once have we had to rescue some lesser species from the grasp of their tentacles. I am sorry to confess this, for the *Anthea* is a favourite of mine; I would try, however, to defend him from another charge brought against him, namely that of stinging. Of course one affirmative declaration must outweigh any number of negative assertions, yet we have all frequently handled them, without experiencing any unpleasant sensation. The tentacles adhere very firmly to any object brought within their grasp, but scarcely more so than those of *Actinia coriacea*.

It lives well in confinement, and is amusing from its activity and from its constant changes of form. They sometimes attain a large size: one found in a pool amongst the Warren Rocks had the tentacles, when erect, almost of the calibre of a goose-quill, and must have been, when in full expansion, considerably more than an inch in breadth, exclusive of the tentacles. In the same pool were five other specimens, but all of smaller size. I have seen twenty even in a very little pool in the same locality.

They vary much in form; sometimes their bodies are elongated or cylindrical, with the tentacles hanging loosely around in graceful curves, and shortly after the Anemone may stand up a complete Briareus, with arms erect, spread out to search for prey; then, if ever, it would be supposed most likely to sting, but my fingers have often been within its grasp without any such effect. At other times its body is shortened and thick, and the tentacles have undergone the same change. It has the power of wonderfully altering the size and shape of these. They vary in number, though always numerous, and the animal can turn and twist them in any direction. It often curls them round at the points like crooks, sometimes enlarges them like clubs: as in many of the Anemones, the mouth of the *Anthea* is sometimes pouted.

The usual colour of this Anemone, as found with us, is—body of a uniform brownish olive, with the tentacles of a grayish colour, having also a longitudinal lighter stripe along the upper surface; sometimes, however, they assume a much gayer tint, and the brown hue of the body becomes more red, almost claret-colour, whilst the tentacles from gray are changed to emerald-green, and adorned with a bright ring of rose-colour at about half-way between their base and extremity.

It is difficult to account for the changes in the inhabitants of the rocks at very short distances of coast, and under apparently similar circumstances, but a very marked difference there decidedly is: this fact makes me, however, confident of fresh results from fresh researches. Mr. Gosse's book, and the works of other naturalists, prove indeed that there are many species yet unnoticed by us; there are some probably as yet unseen by any one. I would hope, therefore, that at some future visit more may be done, especially along the limestone portion of the coast, as this was only examined at one spot (Meadfoot Sands, Torquay), and there but very imperfectly.

Dec. 16th, 1854.

VIII.—*On a Monstrous Oyster Shell.* By George Busk, Esq.

[With a Plate.]

To the Editors of the Annals of Natural History.

Gentlemen, Greenwich, July 31, 1854.

The shell, of which the enclosed drawing (Pl. III. B. figs. 1 & 2. nat. size) will give some idea, was picked up, I believe, on the coast of Pembrokeshire.

It appears to be a very anomalous production, and as I do not myself understand how it has been formed, and cannot find any one who can tell me, I have thought a notice of it might interest some of your readers who may be better able to explain the matter.

Fig. 1 represents the outside, and fig. 2 the inside of the shell. It is obviously a single valve of some bivalve shell, not unlike that of an Oyster, formed upon and partly made up by one valve of a *Pholas candida.*

There is a faint muscular impression about the middle of the concave part (*a*, fig. 1), and the hinge appears to be represented by a triangular depression, immediately within the beak (*b*, fig. 2).

The whole shell is of a light brownish colour, and the inner surface is perfectly smooth and continuous throughout. The outer surface of the *Pholas* valve is covered by a thin transparent coating—like varnish—of shelly matter, through which the worn (?) surface of the original valve is plainly seen.

I am, Gentlemen, yours obediently,
GEORGE BUSK.

IX.—*On* Hypericum anglicum. By CHARLES C. BABINGTON, M.A., F.R.S. &c.*

SINCE the publication of my remarks upon the supposed *Hypericum anglicum*, found near Cork by Dr. Balfour (Ann. and Mag. Nat. Hist. Ser. 2. xi. 360; Edin. Bot. Soc. Trans. iv. 169), I have received additional information concerning it, and have also been favoured with a specimen of an *Hypericum* gathered upon the cliffs above Falmouth harbour in Cornwall, which agrees very exactly with Bertoloni's description of his *H. anglicum.* It appears therefore proper to publish the results of the further study which I have been led to give to the subject, more especially as my opinion has undergone a change.

In my former paper it was stated to be doubtful if the plant there called *H. anglicum* ought to be separated specifically from *H. hircinum*, and I am now strongly disposed to believe that they are indeed one species. At the time of that publication I had been led to suppose, that the plant found near Cork was wild there; but am now informed by Mr. Isaac Carroll of that city, that the station noticed by Dr. Balfour closely adjoins, and, indeed, one side of it forms the "boundary of Lota Wood, whence many half-naturalized species have been recorded by Dennis Murray, such as *Geranium phæum*, *Atropa Belladonna*, &c., plants by no means native there; and from this place," Mr. Carroll thinks that the *Hypericum* in question has migrated. It is not contained in Dr. Power's very carefully prepared Flora of Cork (1845), and therefore was not known to him as a native, or even a naturalized plant. He was particularly careful to include all plants of both these kinds. It is now perfectly naturalized, but only, as Mr. Carroll informs me, in suspicious places. In addition to the station near Lota Wood, a single "plant of it grows on an old wall at Monkstown, but although there is no modern garden from which it might have escaped, yet the wall is close to an old castle and burying-ground, localities always famous for doubtful species." Mr. Carroll thinks that *Hyper. calycinum, Vinca major, V. minor, Hesperis matronalis, Iris Pseudacorus,* and *Sambucus Ebulus* are similarly escapes from cultivation in the neighbourhood of Cork. This information seems to settle in the negative the claims of this plant to be considered as a native of Britain*.

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* Read before the Edinburgh Botanical Society, Dec. 14th, 1854.

The probability of its distinctness from *H. hircinum* was chiefly founded upon a supposed difference of habit, which I now do not believe to be very great; also upon the shape of the leaves, upon which I am now inclined to place very little weight. The *H. anglicum* (Bab.), but not of Bertoloni, is therefore probably nothing more than *H. hircinum* escaped from cultivation, or perhaps intentionally planted at Lota Wood and elsewhere in the south of Ireland.

Having disposed of *H. anglicum* (Bab.), I have next to consider if there is any British plant according with the *H. anglicum* (Bert.), to which latter plant both of the synonyms quoted in my former paper belong. In the year 1853 I received from Mr. T. R. Polwhele, a student of St. John's College, Cambridge, a fine specimen of an *Hypericum* gathered by him on the "cliff above Falmouth Harbour, Cornwall." This specimen has the branching habit, winged peduncles, large flowers, and long styles of *H. hircinum,* combined with the leaves and sepals of *H. androsæmum.* These are the very points to which Bertoloni directs attention as the distinctive characters of his *H. anglicum,* and as the plant under consideration accords well with the figure erroneously named *H. androsæmum* in 'English Botany,' to which Bertoloni refers as representing his *H. anglicum,* I think that we may reasonably conclude that the Cornish specimen is really *H. anglicum* (Bert.). That some plant agreeing with the figure in 'English Botany' inhabits Britain may be concluded with certainty, when we call to mind the great accuracy of the figures which proceeded from the pencil of the late Mr. James Sowerby. As Bertoloni has made some slight mistakes in the synonymy of his plant, it is proper to consider each of his references separately. I proceed then to take them in order. *H. androsæmum*, Sm. Eng. Flora (iii. p. 323), probably includes both the plant so named and also *H. anglicum*, but the points which would decide the question are not noticed in the description there given. It has been already remarked that Eng. Bot. (t. 1225) represents *H. anglicum*. Curtis, Fl. Lond. (ii. t. 103, as it is quoted in the 'Fl. Italica,' but i. t. 164, as is apparently the more correct reference to that variously arranged work), is a beautiful figure of *H. androsæmum*, and is therefore erroneously placed under his *H. anglicum* by Bertoloni. Hooker's Brit. Flora (ed. 2. p. 332) may include both of the plants. Babington's Manual (ed. 1. p. 57) was intended to include the true *H. androsæmum* alone; for I was then totally unacquainted with the supposed *H. anglicum*, and was in error when quoting Eng. Bot. 1225 as a representation of my plant. The same error I continued to commit in the 2nd and 3rd editions of the 'Manual.' Reichenbach's figure named *H. grandifolium* is far too imperfect for satisfactory determination, but probably does not represent either of the plants under consideration, and what he may have received from the "Isle of Arran, Buteshire," it is impossible to tell.

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* Prof. Balfour states that it was found by Dr. Sibbald on the high road between Aghada and Cloyne, to the south-west of Aghada, and that that gentleman did not remember anything to make him suspect that it had been introduced.

It now only remains for me to place in a technical form the characters of *H. anglicum* according to my present views of it.

H. anglicum (Bert.), stem shrubby 2-edged much branched, *peduncles 2-winged*, leaves subcordate-ovate rather acute, cymes few-flowered, sepals broad unequal, petals twice as long as the sepals, *styles exceeding the stamens*, capsules "oval."

H. anglicum, *Bert. Fl. Ital.* viii. 310.
H. androsæmum, *Eng. Bot.* t. 1225.

The plant is tall, almost shrubby, producing a rather long simple branch from nearly all of the upper axils of the leaves, most of them ending in cymes of from 1 to 5 flowers. The flowers are large, and much resemble both in size and appearance those of *H. hircinum*. The peduncles are furnished with two well-marked wings, extending from their true base at the bracts up to the flower. The sepals are ovate, rather acute, and unequal, and are probably reflexed from the fruit. The styles have a tendency to break off at a short distance from their thick base as the capsule enlarges, and in that state may be mistaken for such short ones as belong to *H. androsæmum*. The capsule is probably rather pointed when ripe, but I have not seen it in that state. It is certainly of that shape in an earlier state.

This plant is more nearly allied to *H. hircinum* than to *H. androsæmum*. It flowers in July, August and September.

Since this paper was written, Dr. Balfour has kindly placed in my hands all his specimens of these plants, and I learn from them that he gathered *H. anglicum* on the banks of the Crinan Canal in Argyleshire (1827), near Culross on the Frith of Forth (1833), and near Galway (1838). It will probably soon be noticed in many other places. It is hoped that these remarks will cause botanists to examine carefully all specimens named *H. androsæmum*, in order that we may soon be informed of the true claims of *H. anglicum* to be separated from it; and may also learn what is the geographical range of each of the plants.

X.—*On the Ornithology of Malacca.*

By Alfred R. Wallace, Esq.

Although Malacca birds are among the very commonest in European collections, I am not aware that the country has been visited by any ornithologist; a few remarks upon the birds I met with may not therefore be unacceptable to your readers. I spent nine weeks there, but for a fortnight I was ill in the town, and seven only were occupied in collecting. Nevertheless I made extensive collections of insects, and procured 135 species of Passerine birds. In the 'Annals' for May 1854 is a list of birds collected during a two years' residence at Barrackpore, which comprises only 127 land birds (including *Gallinaceæ* which I have not reckoned); and in a note of the numbers of Ceylon birds, kindly furnished me by Mr. Edgar L. Layard, I find 165 Passeres were the whole number known to him after several years' researches in that fertile island. Now, as I certainly have not obtained one-half of the birds to be procured in Malacca, we must conclude the locality to be an exceedingly productive one for the ornithologist.

Among the commonest and most characteristic birds are *Cymbirhynchus macrorynchus*, Gm., *Oriolus xanthonotus*, Horsf., *Nyctiornis amicta*, Sw. (one of the loveliest of Eastern birds), the beautiful azure and black *Irena puella*, Horsf., *Megalaima versicolor* (the commonest of the Barbets), *Calyptomena viridis* of Raffles (abundant); and beautiful Kingfishers are not uncommon. The first bird I have mentioned was that which I first shot, and I was both surprised and delighted at its extreme beauty, especially the bright colours of the enormous beak, which all fade in the dry specimens and are replaced by a dull black. The upper mandible is clear sky-blue; the lower bright orange-yellow, margined with blue, and the eyes emerald-green, or blue and black powdered; these colours all contrasting beautifully with the deep black, pure white, and rich claret colour of the plumage. In the smaller species, *Eurylaimus ochromalus*, Raffl., the bill is blue and pea-green.

Besides the *Megalaima versicolor*, three other Barbets are not uncommon, *M. mystacophanos*, Temm., *M. chrysopogon*, Temm., and *M. trimaculatus*, Gr. Notwithstanding their long rictal bristles, these seem to be all fruit-eating birds; as in the stomachs of dozens which I have examined, nothing else was found. They are dull, slow-moving birds, and in their actions much resemble the Toucans and Hornbills. I doubt if they have any affinity to the Woodpeckers, next to which they are generally placed. In the weakness of the feet, the size and shape of the skull and neck, and in the texture of the skin and plumage, and even in their colours, they approach much more nearly to the smaller Toucans.

In the *Picidæ* I was very fortunate, obtaining nearly a complete series of the Malacca species, as the following list will show:—

1. *Meiglyptes tristis*, Horsf. Singapore and Malacca.
2. *M. brunneus*, Eyton. Common.
3. *Phaiopicus rufinotus*, Mulh. Common.
4. *Tiga tridactyla*, Gr. Scarce.
5. *T. Rafflesi*, Vig. Scarce.
6. *Gecinus puniceus*, Horsf. Common.
7. *G. mentalis*, Temm. Common.
8. *Hemilophus Mackloti*, Wagl. Not uncommon.
9. *H. Mulleri*, Bon. ? distinct.
10. *H. javensis*, Horsf. Scarce.
11. *H. validus*, Reinw. Singapore.
12. *Hemicercus concretus*, Reinw. Mt. Ophir.
13. *H.*, n. s.? Like *H. concretus*, but head and crest the same colour as the body.
14. *Sasia abnormis*, Temm. Not uncommon.

The Kingfishers of this part of the world are pre-eminent for beauty; the finest which I obtained were the *Halcyon concreta*, Temm., *H. pulchella*, Horsf., *H. gularis*, Kuhl, the lovely little *Alcedo biru*, Horsf., and a *Ceyx* which I cannot determine, the specimen being young. The birds, however, which I found most abundant and varied were the Thrushes, of the subfamily *Ixodinæ*, and the various strong-legged birds forming the genera *Timalia*, *Macronus*, &c. These latter birds are found to be abundant both in species and individuals when carefully searched for on the sides of roads and other places where there is a thick low jungle, while the former are found on every fruit-tree and about the Malay villages. Their affinities are most intricate and puzzling.

I have eight species of birds, all of an obscure dusky olive plumage and of nearly the same size, which can only be distinguished by minute differences in the bill, in the colour of the eyes, or obscure markings in various parts of the plumage. They appear to belong to the genus *Trichostoma*, Blyth (*Malacopteron*, Gray). They are mostly fruit-eating birds, though they also feed freely on insects. Allied to them is the beautiful *Ixidia cyanoventris*, Blyth, which is not uncommon; also the *Trichophorus gularis*, Temm., the *Pycnonotus ochrocephalus*, Gm., which has a powerful and melodious voice, and may be considered the singing thrush of Malacca; it is often seen in cages.

The *Copsychus Mindanensis*, Gm., has also a very beautiful and varied note, it is the commonest bird in Singapore and Malacca; it feeds much on the ground, and its rich black and white plumage makes it a pleasing object. It is called the Magpie by the European inhabitants here, from its colours and long tail, which latter it throws up vertically when alarmed, at the same time uttering a loud creaking note. Then we have the pretty *Brachypus melanocephalus*, Gm., *B. vidua*, Temm., and *Ixos analis*, Horsf, all common and pretty birds. Of *Ixodinæ* and *Timalinæ* I have procured forty species, some of which I have little doubt will prove undescribed.

The *Pittidæ* and *Cinclidæ* are among the rarest and most beautiful of the Malacca birds; of each I obtained but one species, the lovely *Brachyurus granatina*, Temm., and the elegant *Enicurus frontalis*, Blyth. The *Pittæ* inhabit the dense jungles, where their powerful legs enable them to leap and run so quickly that it is very difficult to shoot them. Flycatchers are rather plentiful in the more open jungles. The *Muscipeta paradisi*, L., is not uncommon, but I could not obtain specimens in full plumage. The beautiful little *Myiagra Mindanensis*, Quoy and Gaim., is also common.

The curious little *Prionichilus percussus*, Strickl., is very abundant along the road-sides, the red spot on its breast making it a conspicuous object. Many species of *Edolidæ* are abundant; besides the lovely *Irena puella*, Horsf., there is the *Edolius remifer*, Temm., and some allied species; and the brilliantly-coloured *Pericrocotus miniatus*, Temm., and *P. flammeus*, Blyth, are more rarely found. Two fine species of *Garrulidæ* are occasionally met with, the *Crypsirhina leucoptera*, Temm., and a species of *Lophocitta*. Three pretty, green birds, of the genus *Phyllornis*, are very common, frequenting the vicinity of houses, feeding on both fruit and insects from low trees and shrubs; they appear to be *P. Cochinchinensis*, Gm., *P. Sonnerati*, Jard., and *P. icterocephala*, Temm.

Of the beautiful little Sun-birds, many species are to be found, but I was not fortunate in procuring them, my list comprising only *Dicæum cruentatum*, L., *Anthreptes lepida*, Lath., *A. hypogrammica*, Mull., and four species of the interesting genus *Arachnothera*, which are both honey-suckers and spider-eaters. The common Starling of Malacca is the *Lamprotornis Cantor*, Gm.; the *Gracula Javanensis*, Osbeck, is also very abundant. Of Finches I obtained two species, of the genus *Munia*, Hodgs., and the house sparrow of Malacca and Singapore, which is found only in the towns; it is like, and perhaps the same as, the European species, *Fringilla montana* of Linnæus.

My stay was too short to obtain many of the larger birds. The Hornbills are very numerous in species, but I only procured three, *Buceros rhinoceros*, L., *B. intermedius*, Blyth (at Singapore), and *B malayanus*, Rafll. (*anthracinus*, Temm.). This last species has the bill white in the male and black in the female, which latter is the *B. nigrirostris* of Blyth. I satisfied myself of this fact from the dissection of about a dozen specimens shot off the same tree. Of Raptores I only obtained five, two Hawks and three Owls. The little *Hierax cærulescens*, L., is the only one I can certainly determine; it often perches on dead trees and stumps. I have found *fruit* and insects in its stomach. In the Rasorial order I was still more unfortunate, not obtaining a single species. I have seen a small Quail, but so wild and in such bushy places that I could never get a shot at it. The Jungle Cocks were often heard crowing near us, and during my visit to Mount Ophir the loud voice of the magnificent Argus Pheasant was heard every evening, and other species occasionally; but these birds are seldom shot, the Malays securing them with snares. I had an old Javanese with me, who had been with Dr. Blume in Java, and since with M. Diard, and had for twenty years been shooting and skinning birds, and even he had never shot an Argus Pheasant, nor indeed seen one till it had been caught in the snare. I will conclude this very imperfect notice by mentioning two birds which are perhaps the rarest I procured, *Acanthylis giganteus*, Temm., and *Macropteryx comatus*, Temm. The first is not uncommon in Singapore; the second is very rare, frequenting the forest only, and probably migrates from Sumatra, whence many peculiar birds appear to visit Malacca at certain seasons.

There are two Portuguese resident in Malacca, whose sole business is procuring and selling the skins of birds and animals. They have numbers of the Malays of the interior in their employ, whom they furnish with ammunition, arsenical soap, &c. All the birds are skinned and put up by these Malays, who are paid a small sum per skin. The greater part of the birds thus come from one or two localities only, where, as this collecting has been going on for years, there can hardly be a new bird to be found. The Malays skin birds remarkably well, some of them preparing even the delicate Trogons most perfectly. They stuff them however too tightly, and their arsenical soap is not well made, many of the specimens therefore lose their feathers.

XI.—*Descriptions of the Animals of certain Genera of Bivalve Shells.* By S. P. Woodward, Esq., F.G.S.

My dear Sir, January 5, 1855.

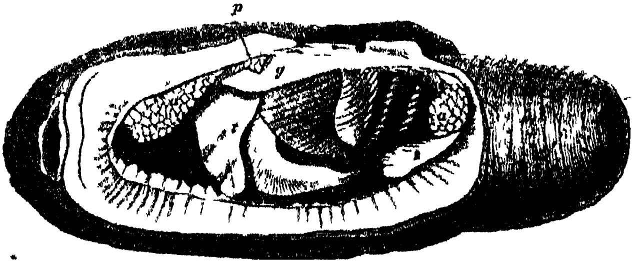
Mr. S. P. Woodward has kindly drawn for me certain genera of Bivalve shells which I had placed in his hands to illustrate my arrangement of the Conchifera. I forward them to you for insertion in the 'Annals,' with the notes which he has made on them.

I am, my dear Sir, yours very truly,
John Edward Gray

Dr. Francis.

Glycimeris siliqua, Chemn. Newfoundland?

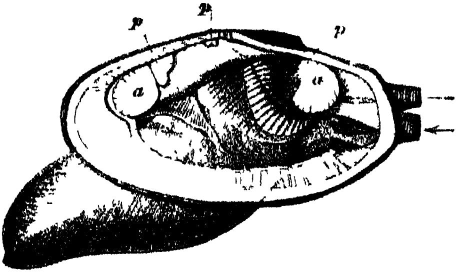
Mantle-lobes united, covered like the siphons with wrinkled epidermis. *Siphons* combined, thick and muscular, not entirely retractile; orifices fringed. *Pedal* opening quite anterior, rather small, with a thickened border. *Foot* thick, conical, pointed. *Palpi* large, sickle-shaped, striated inside, with a broad plain posterior border. *Gills* two on each side, thick, plaited (much crumpled when the siphons are retracted), unequal, the outer shortest and rounded in front.



a, *a*, adductor muscles; *p*, pedal muscle; *s*, siphonal muscle; *f*, foot ; *t*, palpi; *g*, gills

Psammobia pallida, Desh. Red Sea.

Mantle open, margins thick, undulated, double, outer minutely fringed. *Siphons* moderately long, thick, orifices plain; branchial siphon with six longitudinal bands; anal siphon smaller, with eight bands; siphonal muscle moderate, orbicular; siphonal chamber small. *Foot* large, compressed, linguiform; adductors

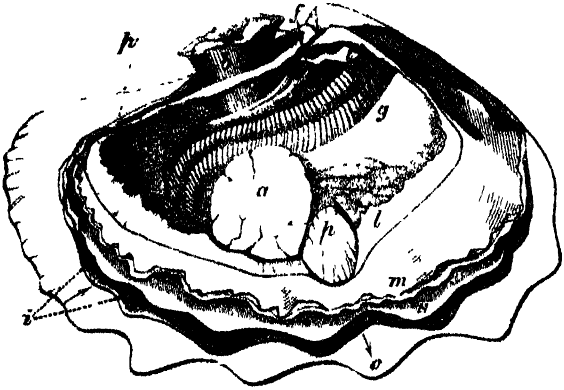


a, *a*, adductor muscles, *p*, *p*, *p*, pedal muscles; the arrows indicate the inhalent and exhalent siphons (much contracted)

rounded; pedal muscles close to adductors, large, oblong. *Palpi* broad at the base, tapering suddenly, very delicate, their front border plain. *Gills* two on each side, recumbent, rather small, unequal, plaited, united behind, inner gill largest, prolonged between the palpi, its inner surface smooth; outer gill much shorter, attenuated in front, with a free, plaited dorsal border.

Tridacna crocea, Lam.

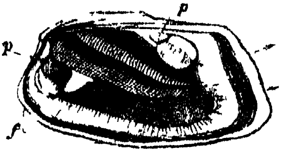
Mantle margins (*m*) double, plain, united by a curtain pierced with three orifices. *Siphonal* orifice on the ventral side, surrounded by a prominent and thickened border (*s*); branchial



orifice (*i*) moderate, simple; anal (*e*) remote, behind the centre, with a tubular valve. *Byssal* orifice (*p*) large, close to the umbo, occupying nearly the whole anterior side. *Byssus* (*b*) very large. *Foot* (*f*) small, finger-like, grooved; pedal muscles thick, attached behind the great adductor. *Adductor* (posterior) round, large, central (*a*). *Pallial* muscle (*l*) thick. *Gills* (*g*) two on each side, long, narrow, deeply plaited, passing from the umbo forwards, uniting behind the byssus and below the adductor, closing the branchial chamber; outer gill linear, composed of a single lamina; inner gill thick, strongly furrowed along the free edge. *Palpi* small, very narrow, pointed, free.

Cypricardia rostrata, Lam. From the Philippines.

Mantle-lobes united and covered (except the siphonal area) with a wrinkled straw-coloured epidermis. *Siphonal* orifices unequal, anal smallest, fringed. *Pedal* opening (*f*) rather large. *Foot* very small, compressed, byssiferous. *Gills* long, narrow, deeply lamellated, very unequal, outer gill rather shorter, and only half as wide as the inner, furnished with a narrow plicated dorsal border; its lower margin free posteriorly, *adhering to the inner gill in front*; inner gill prolonged between the palpi *Palpi* small, triangular, plaited inside. *Adductor* muscles each of two distinct elements; anterior *pedal* muscle distinct, *posterior* combined with adductor.



Cypricardia ? solenoides, Reeve.

Mantle-lobes united, margins slightly cirrated behind. *Pedal* orifice rather large. *Foot* very small, compressed, acute-edged, with a large byssal pore near the heel *Siphons* conical, cirrated externally; orifices cirrated; anal smallest, with a single row of large cirri, branchial with an inner series of large cirri, and very numerous fine cirri outside *Palpi* moderate, obtuse. *Gills* two on each side, deeply plaited, the ridges grooved; outer gill shorter and narrower; inner gill prolonged between the palpi; gills united posteriorly, their *lower margins entirely free*.

XII.—*On Fossil Echinoderms from the Island of Malta; with Notes on the stratigraphical distribution of the Fossil Organisms in the Maltese beds**. By THOMAS WRIGHT, M.D. &c., Professor of the Natural Sciences in the Cheltenham Grammar School.

[With four Plates.]

A. *Notes on the Maltese beds, with the species they contain.*

THE Island of Malta is entirely composed of tertiary rocks of Miocene age, which have been described by Capt. Spratt, R.N.†, and surveyed and mapped by the Earl Ducie*. Through his lordship's kindness, we have been enabled to study a complete suite of Maltese rock specimens, together with an extensive collection of the fossils obtained from them, whilst resident in the island; and it is but just that we should state, at the outset of these remarks, that whatever is valuable in this memoir relating to the stratigraphical distribution of the Urchins and other fossils in these beds, is entirely due to the Earl Ducie, who has most liberally given us all the information he noted on the spot, relative to the range and distribution of the species. It is to be distinctly understood, however, that neither the measurement of the beds, nor the limitation of the range of the fossils in them, are given as absolute truths, but rather as the nearest approximation thereto which the present state of our knowledge permits.

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* Being the substance of a Lecture delivered to the Members of the Cotteswold Club, held at Tortworth Court, September 14, 1854.

† "On the Geology of the Maltese Islands," with Notes on the Fossils by Prof. E Forbes. Proceed of the Geol Soc. London, vol iv p 225

The Maltese islands comprise Malta, Gozo, and Cummo Malta is seventeen miles in length by seven in breadth; Gozo is nine in length by five in breadth; and Cummo about two in length by one in breadth. The direction of their long axis is S.E. and N.W., which, with the channels, is about twenty-nine miles in length. All the rocks are sedimentary and marine, having a slight inclination from N.E. to E.N.E.; their direction corresponds with that of the Apennines, and with the intermediate line observed in Sicily from the Val di Noto to Polizzi. Numerous faults traverse the N.W. half of Malta and the S.E. of Gozo, which have much disturbed the beds, caused the depressions now forming the north and south channels between Cummo and Malta and Cummo and Gozo, and left the islet of Cummo an isolated fragment of the uppermost beds, which attests the former continuity of the land, before these islands were fractured by subterranean and denuded by aqueous agency. "The mineral deposits," says Capt. Spratt, "composing this group, have a thickness of 800 feet visible above the sea; they lie nearly horizontal, and are conformable, although there is a great diversity of mineral character and condition in the series. None of the deposits are wholly destitute of organic remains; but, on the contrary, they generally contain them in tolerable abundance, and in a good state of preservation." The strata may be divided into five groups, each of which contains fossils that are special to it, very few of the species being common to the whole series. These, in a descending order, are, 1st, *the coralline limestone*; 2nd, *the yellow sand*; 3rd, *the clay*; 4th, *the calcareous sandstone*; 5th, *the hard cherty limestone*.

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* The Earl Ducie kindly presented a copy of this map to Mr. Goodenough, book- and map-seller, Strado Reale, Malta, by whom it is now being published.

No. 1. *The coralline limestone,* consists of a reddish-white calcareous rock, mostly hard and compact, and sometimes changed into an indurated calcareous sandstone. It attains a thickness of 100 feet, but has been much denuded in several localities. Some isolated portions of this bed, from being slightly variegated in colour, were formerly used for certain durable work, under the name of Gozo marble.

Fossils of No. 1.

MOLLUSCA.

Voluta, cast of a large species
Haliotis, ditto of a n. sp
Trochus, ditto
Spondylus quinquecostatus, *Desh.*
Ostrea Boblayei, *Desh.*
—— Virleti, *Desh*
Pecten Pandora, *Desh*
—— squamulosus, *Desh*
—— Burdigalensis, *Desh*
Arca, casts of.
Cytherea, ditto.

BRYOZOA.

Eschara monilifera
Escharina, n. sp

CRUSTACEA

Carapaces and chelæ of several species.

ECHINODERMATA.

Cidaris Miletensis, *Forbes.*
Echinus Duciei, *Wright.*
Echinolampas Deshayesii, *Desor.*
Clypeaster crassicostatus, var of C *altus.*
Brissus latus, *Wright*
—— imbricatus, *Wright*
—— - oblongus, *Forbes, MSS*
Brissopsis Duciei, *Wright.*
Schizaster eurynotus, *Agassiz*
Pericosmus excentricus, *Wright*

CORALLIA

Stylastræa.

No. 2. *The yellow sand,* is sometimes slightly indurated, and has an abundance of greenish-black grains intermixed with it. In some places it abounds with Foraminifera. Enormous numbers of *Lenticulites complanatus,* Defr., the flat side of the shell corresponding with the bedding of the rock, occur in some localities, as in the cliffs of Ramala Bay, Gozo, and in many places in Malta. Intercalated with these Nummulites are banks of oysters, the teeth and vertebræ of fishes, especially those of the great shark, *Carcharodon megalodon,* with the bones of Cetacea. The greatest number of Echinoderms are likewise found in this bed. It varies in thickness from 10 to 40 feet.

Fossils of No. 2.

MAMMALIA, determined by Prof. Owen (Forbes).

Delphinus, more than one species
Manatus? bones apparently of this genus.

FISHES, determined by Sir Philip G. Egerton (Forbes).

Cerax aduncus, *Agass.*, teeth of
Carcharodon megalodon, *Agass.*, do
Carcharias productus, *Agass.*, do
Oxyrhina xiphodon, *Agass* , do.
—— hastilis? *Agass.*, do.
—— Mantelli? *Agass.*, do
Hemipristis serra, *Agass.*, do.
—— paucidens, *Agass.*
With other undetermined Squalidæ

MOLLUSCA.

Nautilus, 2 sp., undescribed.
Scalaria retusa, *Brocchi.*
Voluta, Mitra, Cypræa, Conus, 2 sp., Columbella, Oliva, Natica, Turritella, Turbo, Pleurotoma, Pyrula, Phorus, Trochus;—casts only of these genera
Ostrea Virletii, *Desh*
—— navicularis, *Desh.*
Pecten cristatus, *Bronn*
—— squamulosus, *Desh.*
—— Burdigalensis and 3 other sp.
Arca, Isocardia, Venus, and Tellina, in the form of casts
Terebratula ampulla, *Brocchi.*
—— bipartita.

BRYOZOA.

Cellepora mammillata.
Retepora

ECHINODERMATA.

Clypeaster altus et var. C. turritus, *Leske*
—— marginatus, *Lamk.*
—— folium, *Agass.*
Echinolampas Richardi, *Desmoul*
—— Kleinii, *Goldf.*
Conoclypus plagiosomus, *Agass.*
Brissus oblongus, *Forbes.*

FORAMINIFERA.

Lenticulites complanatus, *Defrance.*

CORALLIA

Caryophyllia Fungia

No. 3. *The clay bed*, has a dark blue, drab, or a light gray colour, and is much charged with iron. In it are found crystals of gypsum, and occasionally nodules of sulphur. It varies in thickness from 30 to 60 feet. It is the retentive water-bearing stratum of the islands, and all the water falling upon the upper beds percolates through them, and bursts out in springs along their line of junction with the clay. Casts of shells and fragments of bones are very abundant in it; but Echinoderms are comparatively rare.

Fossils of No. 3

FISHES.

Teeth of Myliobatis, Lamna, Carcharias, and Euphyllia, are abundant.

MOLLUSCA

Megasiphonia zic-zac? (allied to the London-clay species)
Scalaria, Pleurotoma, Mitra, Cassis, Rostellaria, Conus, 3 or 4 sp., Pecten, Ostrea, Cardita, Lucina.

ECHINODERMATA

Spatangus Desmarestii, *Goldf*
Pericosmus latus, *Agass.*

CORALLIA

Fungia?

No. 4. *The calcareous sandstone.*—"This bed covers the greater part of the island of Malta. From it nearly all the building stone is procured, and it is likewise the rock from which the Maltese vases are cut. The lower beds abound in Echinoderms. *Scutella* and *Schizaster* are not unfrequent; but *Hemiaster Scillæ* is the most abundant species. These Urchins are often seen standing out in relief on the beach, the sea having worn away the surrounding rock. They are very serviceable in affording a foot-hold on the rocks, which otherwise would be dangerous to land upon." (*Lord Ducie.*) This bed is subdivided by Capt. Spratt into five strata, which he thus describes:—

"D. is a white calcareous sandstone, lying subjacent to the marl, into which it quickly passes, and is from 20 to 30 feet in thickness.

"E. is a bed of fine-grained sandstone, 15 to 20 feet thick, of a reddish-white, and sometimes gray colour. These contain several species of Foraminifera.

"F. a pale yellow calcareous sandstone, often containing flinty nodules, from 30 to 50 feet thick. In some parts it is thinly stratified, and separable into brittle plates of sandstone; but more generally it assumes a closely bound and unstratified character, when it is used for building; but it is very liable to exfoliate on exposure to the weather.

"G. Chocolate-coloured nodules, irregular in figure and size, in calcareous sandstone, with which are mixed casts of shells, Caryophyllia, and other organisms; also fishes' teeth, vertebræ, and coprolites are very abundant. All the nodules are of organic origin; it is, in fact, a bone-bed of considerable extent, for it preserves a very uniform character throughout the islands; but in Gozo it is more developed, and contains more remains, especially in a flat ledge just above the sea-level, under the cliffs of Fort Chambray, and at Marsa il Forno, on the north-east coast, where its durability has checked the encroachment of the sea. Its thickness is estimated at from 2 to 8 feet.

"H. A close-grained, pale yellow sandstone, incapable of being split along the line of bedding. It is extensively quarried for building and other purposes, being easily cut with the knife or saw. Large blocks of it are turned into pillars, vases, balustrades, and other architectural ornaments. This stone is extensively used for building in the islands; and, for the same use, is largely exported to many parts along the shores of the Mediterranean. It attains a thickness of from 40 to 50 feet.

"The stone from which the finely-carved vases are cut, comes from the lower part of this bed, and is obtained near Naxiar. The rock in this locality dries whiter, is finer grained, and more compact than in general."—*Spratt.*

"It is impossible to distinguish between the beds D, E, F, in the above grouping, except in cliff-sections."—*Earl Ducie.*

Fossils of No. 4.

REPTILIA.

Chelonia, sp

FISHES.

Pycnodus, numerous teeth of this genus, with vertebræ and other bones of this class

MOLLUSCA.

Nautilus, sp undescribed.
Scalaria Duciei.
Conus, Cypræa, Solarium, Natica, Phorus, casts only.
Pecten laticosta.
—— Burdigalensis
Lucina Tellina.

CIRRHIPODA.
Balanus stellaris.
Lepas, sp.
CRUSTACEA.
Numerous remains of this class
ECHINODERMATA
Schizaster Parkinsoni, *Defrance*
Schizaster Desori, *Wright.*
Spatangus Hoffmanni, *Goldf.*
Scutella subrotunda, *Leske*
—— striatula, *Marcel de Serres.*
Brissopsis crescenticus, *Wright.*
Hemiaster Grateloupi, *Desor*
—— Scillæ, *Wright.*
—— Cotteaui, *Wright.*

No. 5. *The hard cherty limestone*, "is a yellowish-white cream-coloured limestone, having sometimes semi-crystalline strata alternating with an oolitic grit or sandstone, apparently composed of minute fragments of shells and corals. It attains a considerable thickness, since nearly 400 feet of it in perpendicular depth is visible on the north-west coast of Gozo" (*Spratt.*) "This bed forms a high and rocky coast-line on the south end of Malta, and dipping to the north appears about the water-line in the neighbourhood of Valetta and Sliema, forming a barrier to the sea. Probably the softer superincumbent beds have in course of time been worn away, till the appearance of this rock arrested any further encroachment. A *Scutella invariably* marks the junction of this bed with No. 4." (*Earl Ducie.*) The New Dock is built of this rock, and it is quarried in several places for building purposes, and it is likewise burned for lime.

Fossils of No. 5.

The fossils of this bed are imperfectly known, from being obtained with much difficulty. Of Mollusca, casts of *Solarium*, *Conus*, *Phorus*, *Natica*, *Cypræa*, *Pecten*, *Lucina*, and of the Cirrhipoda, *Balanus*, have been recognized in it. Of the Echinodermata, "*Scutella subrotunda*, *Clypeaster*, sp., *Brissus*, sp., identical with that of No. 2. Such is also the case with the Pectens." (*Forbes.*)

We cannot conclude our brief notice of these Maltese deposits without alluding to a similar Urchin bed of the same age in the island of Corsica. Through the kindness of our friend M. Michelin, the eminent zoophytologist of Paris, we received some time since a number of *Echinidæ* from this Corsican deposit, which we have carefully compared with the fine suite of Maltese Echinoderms now before us. Many of the species from Corsica and Malta are identical, although some from both islands are special to each region. From these data we conclude, that the deposits containing the Echinoderms described in the sequel of this memoir are of the Miocene period, and of the same age as the tertiaries of the south of France, the north of Italy, and of Doberg bei Bünde in Westphalia. M. Collomb, an eminent French geologist, lately visited the Urchin bed near

Bonifacio in Corsica, and has given an account thereof in a letter addressed to Prof. Constant Prévost; the following abstract relating thereto will be read with interest:—

"We shall quit now," says M. Collomb, "the eruptive rocks, and transport ourselves to the south, at Bonifacio, where we have remained some days, to go and see the bed of fossil Urchins. They are found in a fragment of limestone completely enclosed in the granite. Bonifacio is built upon a high escarpment of this limestone, formed of horizontal beds having a coarse structure, full of the fragments of shells, the species of which were indeterminable. This escarpment is incessantly beaten and demolished by the action of the wind and the sea. Upon all this coast the beds overhang, and are worn into caverns by the inroads of the sea.

"The bed of Urchins is situated at some leagues to the north-east of Bonifacio, towards the roadstead of Santa-Manza, at the limit of the granite. The escarpment itself is here granitic, and the Urchin limestone caps the granite. The bed which contains the most beautiful specimens is only accessible by means of a ladder, and their extraction is difficult."

The Calcaire à Oursins is only found in three localities in Corsica, at Bonifacio, at Aleria, and at Saint-Florent, and always in small detached beds of inconsiderable extent, which do not extend into the interior of the island. The deposits of Bonifacio and Saint-Florent were the only ones visited by M. Collomb*. The rock is a light-coloured limestone, sometimes white and soft, or hard and cherty, and contains an abundance of small quartz pebbles derived from the decomposed granite.

B. *Description of the Fossil Maltese Echinoderms.*

Cidaris Miletensis, Forbes MSS., n. sp. Pl. IV. fig. 1 *a–c*.

Test oblately spheroidal, much depressed at both poles; ambulacral areas undulated, depressed in the centre, with an elevated marginal row of close-set tubercles on each side of the areas; poriferous avenues of the same width as the areas; interambulacral areas rather prominent, with two rows of primary tubercles, about six in each row; mammillary eminences large, each with a circle of boundary granules; spines nearly the diameter of the test in length, tapering from the base to the apex; mouth-opening very large.

Dimensions.—Height $\frac{8}{10}$ths of an inch; transverse diameter $1\frac{3}{20}$ inch.

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* Bull. de la Soc. Géol. de France, tom xi. p. 67 *et seq.*, 2 série.

Description.—This is a very rare Urchin in the Maltese beds. It has an oblately spheroidal figure, and is much depressed at both poles; the ambulacral areas, with the poriferous zones, are gently undulated; they measure together $\frac{3}{20}$ths of an inch in width; the areal band is depressed in the middle, and its elevated margins are covered with two rows of large equal-sized close-set granules; internal to these are two rows of much smaller granules, and down the centre is a depressed furrow: the poriferous avenues lie likewise in depressions, bounded internally by the marginal granules of the ambulacral areas, and externally by the encircling granules of the primary tubercles: the inter-ambulacral areas are 3½ times the width of the ambulacral; they form rather prominent convex portions of the test, with from five to six rows of primary tubercles in each of the two rows of these areas: the areolas are large and prominent, the summits are smooth and without crenulations, and the tubercles, which are proportionately large, and with a very small perforation in their summit, stand well out from the body: a circle of larger granules surrounds the base of the mammillary eminences; these circlets are each complete in the two superior tubercles, but one series is common to two tubercles in those near the mouth; the boundary in all, however, is defined, as none of the areolar spaces are confluent: in the centre of the interambulacral areas is a depressed space, which is filled with small close set granules: the mouth-opening is very large, and that for the apical disc is so likewise: the spines taper gently from the shoulder to their apex; they are round, and sculptured with longitudinal lines; their absolute length is not determinable, as neither of those before us are perfect; they may have attained the length of the diameter of the test.

Affinities and differences.—We know so few true *Cidarites* from the tertiary rocks, that materials for comparison fail us. The only species we possess is the *C. Alabamensis*, Morton, from the tertiaries of the U. States, which has nearly straight ambulacra, ten tubercles in each row in the interambulacra, with wide intertubercular spaces between each pair of rows. The Maltese Urchin differs essentially from this species, and may be easily distinguished from it by the concave ambulacral areas, and the marginal rows of tubercles that define these portions of the test. It is somewhat remarkable that we should have discovered so few Cidarites in all the Urchin beds that have been so diligently explored in the tertiary beds of Europe.

Locality and stratigraphical range.—This species has been found only in bed No. 1, the Gozo marble, where it is rare.

Echinus Duciei, Wright. Pl. IV. fig. 2.

Test circular, much depressed: ambulacral areas more than half the width of the interambulacral, with two rows of marginal, nearly equal-sized tubercles throughout, and two other rows within these, extending from the border to the mouth; one of these inner rows ascends a short way above the border: interambulacral areas with eight rows of tubercles at the border, diminishing to two rows above the others, disappearing or becoming of secondary size; from the border to the mouth, the eight rows continue of uniform size: the pores are in triple oblique pairs; between each pair there is a slight ridge of the test, which gives a singular zigzag figure to the poriferous avenues: mouth large and decagonal, base flat: apical disc of moderate size, but not preserved.

Dimensions.—Height $\frac{15}{20}$ths of an inch; transverse diameter $1\frac{17}{20}$ inch.

Description.—This beautiful Urchin has been thought to be identical with the *E. Scillæ*, Desmoul., and the one figured by Scilla in pl. 13. fig. 1, pl. 25. fig. 1, and pl. 26. fig. A, B, of his work*; but the number of tubercles on each of the plates in our specimen differs from the *Echinus è Messana* of that author, who has figured only one large tubercle on each plate of that form. From *E. Scillæ* it is certainly distinct, as we know of no Urchin that is common to the cretaceous and tertiary rocks. The test is circular, much depressed on the upper surface and flat below, the ambulacral areas are almost $\frac{4}{10}$ths of an inch in width at the border, where we count four rows of tubercles; the marginal rows are very uniform in size and arrangement from the mouth to the disc; the two internal rows are smaller, and continue from the border to the mouth; one of these extends a short distance on the sides, but on the upper half of the areas there are only the two marginal rows: the interambulacral areas are $\frac{7}{10}$ths of an inch in width at the border; there are eight rows of tubercles at this point and onwards towards the base, they are nearly of the same size; but, from the border to the apical disc, the second row, from the ambulacral areas, alone possesses the size the tubercles have at the border; the tubercles in the others diminish in size, and disappear as the areas become narrower; above, we find only two marginal tubercles of the primary size, and internal to these, a few of secondary magnitude irregularly set: all the tubercles are raised on mammillary eminences, with areolas around their bases, and numerous large granules fill up all the intervening spaces, so that the surface of this *Echinus* has a very tuberculated appearance. The poriferous avenues are on a level with the test; the pores are arranged in triple oblique pairs; between each pair there is a slight elevated ridge; every two ridges of each triple oblique pair of holes is connected by another ridge, which runs at an angle of 45° to them; by this arrangement the poriferous avenues exhibit a curious zigzag character through these little elevations of the test in the line of the pedal pores. The base is flattened, the mouth-opening is large and decagonal, and the jaws and teeth are narrow and much curved inwards; the apical disc is absent in all the specimens we have examined, the space for the same is, however, of moderate size.

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* De Corporibus Marinis Lapidescentibus.

Affinities and differences.—This species may be distinguished from *Echinus Serresii*, Desmoul., from the Molasse de Provence, in having larger tubercles, with less granulation at their base, and the absence of the zigzag ridges between the pairs of pores: from *Echinus dubius*, Agass., another tertiary species from the Molasse of Villeneuve in Provence, it is distinguished by the more uniform size of its tubercles, the depression of the upper surface, and the zigzag ridges of the poriferous zones.

Locality and stratigraphical range.—It was collected from bed No. 1, the Gozo marble, Malta, where it is not uncommon. We have dedicated this species to the Earl Ducie, who collected the beautiful specimens we have figured.

Family Clypeastridæ.

This natural family includes all the Urchins which have a circular, elliptical, or pentagonal form, with a thick test, the surface of which is closely covered with small, nearly equal-sized tubercles sunken in the plates, and surrounded by ring-like areolas; these all carry short hair-like spines. The mouth is large, central and pentagonal, and is armed with five strong jaws which carry the same number of teeth: the anus is posterior, and marginal or inframarginal: the interior of the test is sometimes divided by pillar-like processes of the inner layer of the plates. The dorsal portions of the ambulacral areas have a petaloid form, circumscribed by large poriferous zones; the basal portions are narrow, rectilineal, or branched. The five genital plates form a circle around the madreporiform body, and between these are wedged the five ocular plates. This family includes the genera *Clypeaster*, Lamk., *Laganum*, Klein, *Echinarachnius*, Van Phels., *Arachnoides*, Klein, *Scutella*, Lamk., *Dendraster*, Agass., *Lobophora*, Agass., *Encope*, Agass., *Rotula*, Klein, *Mellita*, Klein, *Runa*, Agass., *Moulinsia*, Agass., *Scutellina*, Agass., *Echinocyamus*, Van Phels., *Fibularia*, Lamk., *Lenita*, Desor.

Genus Clypeaster (Lamarck, 1816).

Form oval, inclining to pentagonal, rostrated before, truncated behind; upper surface more or less inflated, sometimes campanulate, conical or subconical; inferior surface flat, always concave around the mouth, with five straight simple ambulacral furrows proceeding from the angles of the mouth to the border; the dorsal portion of the ambulacral largely petaloid, greatly exceeding the interambulacra in size, and forming elegant leaf-like expansions, in general convex, arched, and prominent; bounded on each side by large poriferous zones, the pores of which are wide apart and united by transverse sulci; the apical disc formed of five genital plates at the summits of the interambulacra, with five ocular plates alternating with them; in the centre of this circle is the spongy madreporiform body, of a pentagonal figure: tubercles uniform in size and very numerous, equally distributed over the test; summits perforated, and surrounded by very deep areolas; mouth symmetrical, central, pentagonal, lodged in a concave depression in the middle of the base; auricles composed of ten distinct auricular processes set in pairs: the jaws form a pentagonal pyramid, composed of ten separate pieces, truncated at the summit, which is bordered by a subcircular band; teeth five, large, and bent: anus small, round, and inframarginal: interior of the test with a number of pillar-like processes towards the border. All the species of this genus live in the seas of warm latitudes, or are found fossil in the tertiary rocks only. We have six living and twelve fossil species.

Clypeaster altus, Leske, sp.

Syn. *Echinus è Melita*, Scilla, Corp. Mar. pl. 9. figs. 1, 2.

Echinanthus altus, Leske, Klein, Echinoderm. apud Leske, No. 48 p. 189. pl. 53. fig. 4.

Echinus altus, Gmelin, Linné by Turton, vol. iv. p. 149.

Clypeaster altus, Lamarck, Hist. Nat. des Animaux sans Vertèbres, 2nd ed. tom. iii. p. 290; Deslongchamps, Encycl. t. ii. p. 199, Defrance, Dict. Sc. Nat. t. ix. p. 449, Blainville, Man. d'Actin. p. 216; Desmoulins, Echinides, no. 7. p. 216; Agassiz and Desor, Cat. rais., Ann. Sc. Nat. tom. vii. p. 130; Sismonda, Ech. Foss. Nizza, p. 46, Ech. Foss. Piem. p. 40; Grateloup, Mem. Foss. Oursins de Dax, p. 41.

Test oblong; anterior border convex; lateral borders undulated; posterior border squarely truncated; marginal fold more or less thickened; dorsal surface elevated into a dome shape; vertex nearly central; ambulacral areas largely petaloid, their base extending nearly to the margin: base flat; mouth large and pentagonal, with a deep sulcus extending from the angles to the border, and corresponding to the middle suture of the ambulacral areas: anus small, round, and submarginal: granulations larger and more prominent at the base than on the dorsal surface.

Description.—This beautiful *Clypeaster* has been so long known, that it seems unnecessary to give any lengthy details of its structure; although it may be remarked, however, that we are not aware that a detailed description of the species exists. It was first introduced to notice through the figure of Scilla, and the specimens before us belong to the same type as that given in his work. Many of the Maltese varieties of this species, however, are remarkable for their deviation from this typical form; the dorsal surface in them rises into a campanulate shape, and the circumference becomes almost round. These varieties constitute the *Clypeaster turritus*, Agass., from the Miocene of Dax, and the *Clypeaster Agassizii*, Sismonda, from beds of the same age near Nice. We have before us a similar conical variety from Malta, belonging to the Museum of the Bristol Institution; and others, collected by the Marchioness of Hastings, are in the Jermyn Street Museum.

All the specimens in Earl Ducie's cabinet, with one exception, belong to what we regard as the typical form. This remarkable exceptional specimen agrees with the brief notice of *C. Tauricus**, Desor:—"Très grande espèce, allongée, pentagonale, à bord fortement renflé. Zones porifères très large à leur extrémité. Tert. du Taurus, île de Crète." If we are correct in referring all these varieties to *C. altus*, it follows that this species has a wide range of deviation from what we take to be its typical form; but these limits of variation are probably not greater in this than in some other species of Urchins. The following table shows the relative dimensions of three forms,—the typical, the conical, and the flattened and tumid varieties:—

Forms.	. Length.	Breadth	Height.
Type specimen	5 inches.	$4\frac{1}{20}$ inches.	$2\frac{1}{8}$ inches.
Conical, var *a*.	$5\frac{8}{10}$,,	$5\frac{3}{10}$,,	$4\frac{1}{10}$,,
Tumid, var. *b*.	$6\frac{8}{10}$,,	$5\frac{6}{10}$,,	$2\frac{4}{10}$,,

The ambulacral areas are largely petaloid, nearly equal in length and width; they are rounded, widely open below, and extend over four-fifths of the dorsal surface in the type form, over nearly three-fourths in the conical form, and over almost four-fifths in the tumid varieties; in all, the areas form prominent convex elevations of the test, which are bounded by wide poriferous avenues, composed of two series of simple pores united by oblique grooves; the internal series of pores are round, the external series are elongated transversely in the direction of the grooves; the pores at the end of the avenues are much more so than those of the summit, the apical disc is small, and occupies the centre of the dorsal surface, lying in a slight depression formed by the bending-in of the summits of the areas; those of the single area, and the antero-lateral and postero-lateral areas of the left side, being rather more prominent than those of the right side of the test. The madreporiform body occupies the whole surface of the disc, the ocular and genital plates being quite indistinguishable from the general structure of the test; the five genital pores pass obliquely into the interior, at a short distance from the disc.

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* Cat raisonné des Echinides, Ann. Sc. Nat. tom. vii. p. 131

The base is flat, and the mouth lies in a very deep depression in the centre of the under surface; the opening is pentagonal, its wide walls being formed by the incurving of the basal portions of the areas; from each of the angles of the pentagonal opening, a deep furrow passes outwards towards the margin of the test, and becomes continuous with the median suture of the ambulacral areas. The jaws are absent in all the specimens we have examined. The anus is a small round aperture, situated near the posterior margin of the base of the test; in some specimens it is elongated in the transverse diameter, and measures about $\frac{6}{20}$ths of an inch across. The tubercles are nearly of the same size on the upper surface, and their summits are level with the test, so that the areolas which surround them are excavated out of the superficial layer of the calcareous plates. The intertubercular surface is ornamented with a microscopic granulation, disposed in circles around the areolas of the tubercles, and filling up all the intervening spaces. The tubercles at the base are larger and more closely set together than those on the dorsal surface; a row of five or six tubercles is seen on each of the interfissural bands of the poriferous avenues.

Affinities and differences.—*C. altus* has many traits in common with *C. rosaceus*. In the general outline, in the size, form and extent of the ambulacral areas, there is much resemblance; but the campanulate form of the dorsal surface, the smallness of the apical disc, and the truncature of the posterior border constitute differences which may be traced through all the varieties *C. altus* assumes. The thickness of the marginal fold, and the great development of the ambulacral flower, when compared with the thinness of the border and the limited extent of the ambulacra, distinguish at a glance *C. altus* from *C. Tarbellianus*, *C. marginatus*, and *C. scutellatus*. The dome-shaped upper surface of *C. umbrella*, with its flattened ambulacral areas and convex prominent interambulacral spaces, its star-like apical disc and small mouth-opening, widely distinguish this species from *C. altus*. The affinity, however, is very near between *C. altus* and *C. crassicostatus*, the principal difference consisting in the more prominent rib-like prominence of the ambulacral areas.

Stratigraphical position.—This is the most abundant of all the Maltese Urchins. It is collected from bed No. 2, the yellow sand, associated with *C. Tarbellianus*, *Echinolampas Richardi*, and the other Echinoderms enumerated in the palæontological *résumé* given in the introduction to this memoir. The test is very well preserved in most specimens. Those from the sand with black particles are in the finest preservation. In this stratum the Urchins are accompanied with *Terebratula ampulla*, *Pecten squamulosus*, *P. Burdigalensis*, *Ostrea Virleti*, *O. navicularis*, and masses of *Lenticulites complanatus*, with *Cellepora mammillata*, *Escharina monilifera*, and other Bryozoa.

It has been collected from the Miocene beds of Port-de-Bouc, Saint-Miniato, Tuscany; Nice, Turin, Ile de Crète, Ile de Caprée; Bonifacio, Corsica; Oran. The Maltese specimens are contained in the British Museum, Geological Museum, Jermyn Street, and Bristol Museum; that from the Ile de Caprée is in our cabinet.

History.—First figured by Scilla, in 1670. The list of synonyms prefixed to this article exhibits the various epochs in its history. In none of the works we have consulted is any detailed description of the species given.

Clypeaster marginatus, Lam.

SYN. Scilla, Corp. Mar. tab. 11. fig. inferior.

Clypeaster marginatus, Lam. An. sans Vert. tom. iii. p. 290, 2nd ed.; Deslongchamps, Encycl. Méthod. t. ii. p. 200; Defrance, Dict. Sc. Nat. t. ix. p. 450; Blainville, Man. Act. p. 216; Grateloup, Foss. Ours. p. 40; Agassiz and Desor, Cat. raisonné, t. vii. p. 131; Desmoulins, Etudes des Echinides, no. 12. p. 218.

Test large, depressed, subpentagonal, margin thin, broad, and expanded; outline of the border undulated; ambulacral areas short, oval, and convex, rising abruptly from the thin border, and forming a dome-shaped elevation in the centre of the dorsal surface; base flat; mouth-opening small and pentagonal, with five simple sulci extending from the angles thereof to the margin; anus small, round, and submarginal.

Dimensions.—Antero-posterior diameter $6\frac{7}{10}$ inches, breadth $6\frac{4}{10}$ inches, height at the centre $1\frac{8}{10}$ inch, thickness of the margin about $\frac{1}{8}$th of an inch.

Description.—This magnificent Urchin was figured by Scilla. The specimens before us agree very well with his drawing, although the foreshortening of the dorsal surface does not give a sufficient elevation to the ambulacral dome. The expansion of the margin, and thinness thereof, make a marked distinction between this and other cognate forms. The figures given by Grateloup of his *C. Tarbellianus* so exactly resemble the large specimen before us, belonging to the Bristol Museum, that we no longer doubt that species being a variety of *C. marginatus*. This species, like *C. altus*, exhibits much deviation from what may be considered to be its type form. A long and attentive study of the *Echinidæ* has shown us, that such difference of outline is the rule, and not the exception, in the group; and that specific characters must be drawn from organic structure, and not merely from outline, if we wish our species to have a permanent place in the register of Nature's forms. The ambulacral areas are gracefully petaloid, rounded at the base and tapering towards the apex; they are convex and prominent, and extend about half-way between the vertex and the border, the test rising into a dome-shaped elevation in the region of the ambulacral areas. From the base of the areas to the circumference the margin is thin and expanded, and in this respect resembles a *Scutella* much more than a *Clypeaster*. The interambulacra between the poriferous avenues form convex elevations, which give a stellate character to the central dome, all the more conspicuous as it rises abruptly from the thin expanded margin, which is almost destitute of any elevation. The tubercles are larger on the basal than on the dorsal surface. In only one of the specimens before us is the inferior surface exposed. The base is flat. The pentagonal mouth is much smaller than in *C. altus*. In a specimen before us, measuring $4\frac{7}{10}$ inches in length, the mouth-opening is $\frac{7}{10}$ths of an inch in diameter; the oral lobes curve inwards and form the interspaces thereof. Acute narrow ambulacral grooves pass outwards to the circumference.

Affinities and differences.—The thin and broadly expanded border of *C. marginatus*, with its short ambulacra, and central dome rising suddenly from the middle of the test, form a group of characters which enable us readily to distinguish this species from its congeners, with one exception, *C. Tarbellianus*. The excellent figures of this Urchin, given by Grateloup in his able Memoir*, we have compared with two forms of *C. marginatus* from Malta, and we confess our inability to distinguish the differences between them and the author's type-figure. Agassiz and Desor consider them to be the same, and we agree with their conclusion.

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* Mém. sur les Ours. Foss. de Dax, p. 40. pl. 1. fig. 5-6.

Grateloup observes, in describing *C. marginatus*, "We ought not to confound this species with that which I have described (*C. Tarbellianus*), with which it has great affinities of form, figure, and size. Its test has also a summit *très-renflé*, convex, and more elevated than in *C. Tarbellianus*; but its border is a little less *évasé*, and much less *tranchant*. The ambulacras are equally shorter, more *redressés*, and of a more oval and acute form." We have only to observe, that the characters here cited vary in different individuals, and at most amount to that limit of variation which we have already observed is seen in all species of Urchins, where a number of individuals of the same form are assembled for comparison.

Stratigraphical range.—This species is found in bed No. 2, the yellow sand, associated with *C. altus* and the other forms enumerated from that stratum; it has been found likewise in the Miocene beds of Touraine, Landes, Naros, Bonifacio, Santa Manza, Corsica; and Dax.

History.—First figured by Scilla, and afterwards by Leske. Fine specimens are contained in the Mus. Jermyn Street, British Museum, Bristol Museum, and the Collection of the Earl Ducie. The specimen in our cabinet is from Santa Manza, and was sent us by M. Michelin.

Clypeaster folium, Agassiz.

Syn. *Clypeaster folium*, Agassiz and Desor's Cat. rais., Ann. Sc. Nat. tom. vii. p. 131.

Test subheptagonal, much depressed; borders thin and sharp like *Scutella*; the petaloid ambulacra short, open, and expanded below; acutely lanceolate at the apex; ambulacral rosette small, and rising gently from the middle of the dorsum; poriferous zones lie in angular depressions; apical disc small, with a central prominent madreporiform tubercle.

Dimensions.—Antero-posterior diameter $1\frac{17}{20}$ inch, transverse diameter $1\frac{13}{20}$ inch, height $\frac{3}{10}$ths of an inch.

Description.—The general outline of this little Urchin, with the structure of its ambulacral rosette, clearly prove it to be a *Clypeaster*, whilst its depressed dorsal surface and thin border show it to have affinities with *Scutella*. Its outline is subheptagonal, with the anterior border slightly produced; the petaloid ambulacral areas are short and widely expanded below, tapering and acutely lanceolate above; their apices closely approach at the vertex, and meet at the circumference of the madreporiform tubercle; the poriferous zones lie in angular depressions of the test, which, added to the convexity of the ambulacra, give a much greater relief to the petaloidal star than in other congeneric forms; the rosette formed by the petaloid portions of the ambulacra is small, being only a little more than one-half the diameter of the antero-posterior axis. The two rows of pores in the poriferous zones diverge gently from each other from the apex to the base, and there are from thirty to thirty-six pairs of holes in each zone. At the junction of the test-plates there are slight depressions on the surface, corresponding to the sutures between the same; the tubercles are small and set rather closely together, and the intervening granulation is quite microscopic; the border is exceedingly thin and entire; the base is concealed by firmly adherent matrix, which cannot be removed without fracturing the test.

Affinities and differences.—*C. folium* is allied to the young condition of *C. marginatus*, but the general flatness of the dorsal surface, and the absence of the campanulate elevation of the ambulacra in that species, added to the greater wideness of the basal opening of the petaloid ambulacral areas, and the more angular depression in the poriferous zones, afford points of comparison whereby these two species may be distinguished from each other: the thinness of the border and flatness of the dorsal surface are diagnostic characters by which it may be known from its congeners.

Locality and stratigraphical position.—The only specimen we know from Malta is that contained in Earl Ducie's collection; it was obtained from bed No. 2. We have another specimen before us, kindly sent by M. Michelin from the Miocene terrain of Balistro, in the Gulf of Santa Manza, Corsica. Agassiz and Desor, on the authority of M. Deluc, give the tertiary of Palermo as the locality of their specimen.

History.—This species is enumerated in the 'Cat. rais.' of Agassiz and Desor, and stated to be "espèce très plate, à bords tranchant." A detailed description of this interesting form is now given for the first time.

Genus SCUTELLA (Lamarck, 1816).

Form in general suborbicular, extremely depressed, almost always discoidal, more or less enlarged behind; border often trenchant, disc entire, margin lobed; posterior border truncated; upper surface slightly convex; ambulacral flower small, with elegant, flat, blunt leaves; poriferous zones forming nearly a closed arch around them at their base; genital pores four, set around the spongy madreporiform body; base flat; mouth small,

central, and pentagonal, with five ramose ambulacral furrows, sometimes branched, passing from the mouth to the border: tubercles microscopically small and very numerous; test thick, interior divided by pillar-like processes: auricles five; jaws forming a more or less elevated star composed of five distinct pieces, each formed by the organic union of two elements; teeth five, linear, and horizontal. This genus, as now limited, contains only fossil species, one of which is from the chalk of Georgia, United States; all the others are from the tertiary rocks.

Scutella subrotunda, Leske.

SYN. *Echinus Melitensis*, Scilla, De Corp. Marin. tab. 8. figs. 1–3.
Echinodiscus subrotundus, Leske apud Klein, tab. 47. fig. 7. p. 206.
Echinus subrotundus, Gmelin, Linné by Turton, vol. iv p. 152.
Scutella subrotunda, Lamarck, Animaux sans Vert. 2nd ed tom. iii. p. 284, Defrance, Dict. Sc. Nat tom. xlviii. p. 230, Desmoulins, Etudes des Echinides, no. 24. p. 232; Grateloup, Ours. Foss. pl. 1. fig 1. p. 36; Agassiz and Desor's Cat. rais., Ann. Sc. Nat. tom. vii. p. 132.

Test very flat, suborbicular; dorsal surface slightly convex; ambulacral areas exceeding in length the semi-diameter of the disc; base slightly concave; mouth central; anus marginal; ambulacral sulci bifid and branched.

Dimensions.—Antero-posterior diameter $2\frac{8}{10}$ inches, transverse diameter $3\frac{2}{10}$ inches, height $\frac{7}{20}$ths of an inch.

Description.—The test of this delicate Urchin is extremely flat; it has an irregular suborbicular discoidal form, with a thin sinuous margin; the dorsal surface is regularly and gently convex. The ambulacral areas are more than half the length of the diameter of the test; they are of an oblong form, lanceolate above, and more obtuse below. The pores in the avenues are widely apart; those in the inner series are round, whilst those in the external series terminate in slits that extend about half way across the interporiferous spaces. The apical disc is large, and the elements thereof are intimately soldered together. The madreporiform tubercle occupies the centre, and the four genital pores are pierced at unequal distances around it; the anterior pair are smaller and closer together than the posterior pair; the five ocular pores are very small. The margin of the disc is very thin, and has a sinuous outline; five of the curves thereof correspond to the ambulacral areas, and those appertaining to the postero-lateral areas are the deepest and best defined; a small notch indicates the site of the anal opening. The ventral surface is slightly concave. The mouth, about two lines in diameter, is central and subpentagonal; from the angles thereof, five ambulacral sulci radiate outwards, which soon become bifid, each trunk becoming dichotomously branched in old individuals. The anal opening is round, about half the diameter of the mouth, and is situate near the posterior border. The tubercles are small, and closely placed together; they are nearly of a uniform size on the dorsal surface.

Affinities and differences.—*S. subrotunda* so closely resembles *S. striatula*, *S. Faujasii*, and *S. producta*, that it requires an attentive study to discover the differences between them. As we possess single specimens only of these forms, determined and presented to us by M. Michelin of Paris, we are certain of their identity with the types they represent. The test is narrower before, and the ambulacral areas are much smaller in *S. striatula* than in *S. subrotunda*; the ambulacral areas are wider, their bases and apices are more obtuse, their sides flatter, and their terminations are more truncated, and the anus further from the border in *S. producta* than in *S. subrotunda*; the test is more convex on the dorsal surface, the apical disc is wider, the margin is thicker, the base flatter, and the anal aperture much further from the border in *S. Faujasii* than in *S. subrotunda*; the test is more produced posteriorly, the margin is more sinuous, the ambulacral areas are more equally lanceolate at the base and apex, the inner row of pores of the same curve more gracefully outwards, and the anus is further from the border in *S. Brongniartii* than in *S. subrotunda*. The size and pyriform shape of the ambulacral areas, the absence of sinuosities in the margin, and the greater convexity of the dorsal surface, distinguish *S. Paulensis* from *S. subrotunda*.

Stratigraphical range and distribution.—This species is not uncommon in the calcareous sandstone bed No. 4, and in the junction beds of No. 5, the hard cherty limestone, at Malta. It is found likewise "in the marine calcaire grossier in the environs of Bordeaux; at Bazas, Léognan, Gradignan, Douai, in Dauphiné; in Tourraine; in Anjou; at Montpellier." (*Grateloup.*)

History.—The table of synonyms shows the phasis of the history of this species, although other forms have been mistaken for it: in fact, the species of *Scutella* approach each other so closely, that, without an authentic series of specimens for comparison, similar mistakes may be made. This Urchin is found in all the public collections. The specimens before us are from Malta and Léognan.

Scutella striatula, Marcel de Serres.

Syn. *Scutella striatula*, Marcel de Serres, Géognosie des Terrains Tertiaires, p. 156; Desmoulins, Etudes des Echinides, no. 25.

p. 234; Agassiz, Monogr. des Scutelles, tab. 18. fig. 1–5. p. 81; Agassiz and Desor's Cat. raison., Ann. Sc. Nat. tom. vii. p. 134. *Scutella subrotunda*, Grateloup, Mém. Ours. Foss. tab. 1. fig. 1. p. 36.

Test very flat, suborbicular; dorsal surface very slightly convex; ambulacral areas small, short and narrow, less than the semidiameter of the disc; base nearly flat; mouth central; anus marginal; ambulacral sulci bifid.

Dimensions.—Antero-posterior diameter $2\frac{7}{10}$ inches, transverse diameter $2\frac{9}{10}$ inches, height $\frac{7}{20}$ths of an inch.

Description.—This Urchin so nearly resembles *S. subrotunda*, that it may be doubted whether it is entitled to rank as a distinct species, or ought rather to be considered as a variety of that form. The two specimens before us are from localities widely apart from each other. One is from the Miocene terrains of Terre-Nègre, near Bordeaux, the other from the calcareous sandstone of Malta. Still the similarity exhibited by these specimens, and the persistence of those characters which have been considered as specific, incline us to think that *S. striatula* may be distinct from *S. subrotunda*. The ambulacral rosette is small; the areas are short, narrow and lanceolate, and are less than the semidiameter of the test; the apical disc is small; the madreporiform tubercle is prominent and central; the granulations are almost microscopic; the base is flat; the mouth is small and central, and the anus marginal; the ambulacral sulci are bifid; the margin of the test is thin, and the sinuosities well marked. Let the student compare these characters with the detailed description of *S. subrotunda* given in the preceding article.

Locality and stratigraphical range.—It was collected from bed No. 4, the calcareous sandstone at Malta, where it is not common. Our French specimen is from the middle tertiaries of Terre-Nègre.

Genus ECHINOLAMPAS (Gray, 1835).

Test of an elongated or subdiscoidal form; petaloid portion of the ambulacral areas large, generally elevated into convex leaves, contracted towards the base, where they cease to rise above the level of the test; inferior surface concave towards the mouth, which is median, symmetrical, pentagonal, and surrounded by five lobes; basal portions of the ambulacra with five short poriferous zones around the mouth; anus transversely oblong and inframarginal; apical disc small and excentral, five genital and five ocular plates placed around the madreporiform body; tubercles small, uniform and numerous, sunk in the test, and surrounded by ring-like areolas. Three species are living in the seas of warm latitudes; the others are fossil, mostly in the tertiary rocks. A few are found in the upper stages of the cretaceous series.

Echinolampas Kleinii, Goldf.

SYN. *Clypeaster Kleinii*, Goldfuss, Petrefact. Germaniæ, tab. 42 fig. 5. p. 133.

Echinolampas Kleinii, Desmoulins, Etudes des Echinides, p. 346. no. 14; Agassiz and Desor, Cat. raisonné, Ann. Sc. Nat. tom. vii. p. 166.

Test ovato-orbicular in the outline, with the posterior border slightly produced; dorsal surface convex, posterior half more elevated than the anterior; ambulacral areas unequal, usually on a level with the general surface, but sometimes more convex and prominent than the rest of the test; apical disc excentral and anterior; base concave; mouth excentral and anterior; anus inframarginal; both mouth and anus transversely oblong.

Dimensions.—Antero-posterior diameter $2\frac{9}{20}$ inches, transverse diameter $2\frac{13}{20}$ inches, height $1\frac{9}{20}$ inch.

Description.—This Urchin has been well figured by Goldfuss, and is a very characteristic fossil of the Miocene tertiary beds of Westphalia, where it appears to be common. The specimen before us is the only one we know from Malta. The circumference is nearly ovato-orbicular, slightly inclining to an obsolete pentagon, with the posterior border most produced. The dorsal surface is highly convex, the posterior half being much more so than the anterior. The ambulacral areas are unequal, as regards length, width and development; the single anterior area is the shortest and narrowest, the antero-laterals are next in size, and the postero-laterals are the most fully developed; they have all a lanceolate form, with blunt apices. The surface of the areas is on a level with that of the interambulacra, in the specimen before us; but in some of the Westphalian Urchins the ambulacral areas form convex projections on the surface of the test. The poriferous avenues, extending down more than two-thirds of the dorsal surface, are well marked in our specimen, and lie in depressions of the test; they consist of two series of pores; the internal holes are round, the external run into oblique slits that have a direction upwards and inwards; the pores on the right and left sides of the areas do not always correspond in length; thus, the anterior pores in the antero-lateral areas are often only half as long as those on the posterior side of the same areas, and we see a similar inequality, although not to the same extent, in those of the single ambulacrum. The anterior and posterior pair of the interambulacral areas are much alike in form and development; but the single interambulacrum is different, it forms a more convex eminence than the others above, and is produced into a slight caudal appendage behind. The apical disc is small and excentral, situated nearer the anterior border. The madreporiform body occupies the centre, around which the four genital holes are pierced. The base is concave; the mouth is nearer the anterior border, is transversely oblong, and surrounded by five lobes, formed by the termination of the interambulacra; the posterior single lobe is the largest; the anterior pair are next it in size, and the lobes of the postero-lateral areas are the smallest and most contracted. Between the five oral lobes, the poriferous terminations of the ambulacral areas form petaloidal depressions, which are perforated with numerous holes; these run out and form lines which indicate the basal boundaries of the areas. The anus is transversely oval, $\frac{4}{10}$ths of an inch in its long diameter, is more convex on its anterior than its posterior border, and is situated close to the margin, it is rather larger than the mouth-opening. The tubercles are small, uniform in size, and closely set together on the dorsal surface, and longer and more widely apart on the base.

Affinities and differences.—The great convexity of the dorsal surface, the greater elevation of the posterior than the anterior half thereof, the inflated ridge-like eminence formed by the single interambulacrum, and the well-defined character of the poriferous avenues, form a group of characters by which *E. Kleinii* is distinguished from its congeners. It has many points of resemblance in common with *E. ovalis*; but the greater length of the ambulacral areas in this species makes a marked distinction between them; moreover, in *E. Kleinii* the base is concave, whilst in *E. ovalis* it is convex; the latter form is likewise flatter and more oval, and its apical disc more excentral than in *E. Kleinii.*

Stratigraphical position.—Collected at Malta, from bed No. 2, where it is very rare. It is found, according to Goldfuss, in the Miocene beds at Bünde, Osnabruck, Astrapp, and Merminghüfen, in Westphalia.

History.—Admirably figured and well described by Goldfuss. The only Maltese specimen we have seen of this species is that collected by the Earl Ducie, which is in his lordship's museum.

Echinolampas Deshayesii, Desor, sp. Pl. IV. fig. 3 *a–d*.

Syn. *Echinolampas Hayesiana*, Agassiz and Desor, Cat. raisonné, Ann. Sc. Nat. tom. vii. p. 166.

Test oval, depressed; ambulacral areas narrow; the poriferous zones contracted, without apparent connecting transverse sulci;

apical disc small and nearly central; base convex; mouth and anus large.

Dimensions.—Antero-posterior diameter $2\frac{1}{10}$ inches, transverse diameter $1\frac{9}{10}$ inch, height $\frac{8}{10}$ths of an inch.

Description.—The form, size and structure of the ambulacral areas afford the best guide to a knowledge of the numerous species of this group. The Urchin before us has an oblong form, depressed at the dorsal surface, convex at the base, and slightly produced posteriorly. The ambulacral areas are narrow at their widest part; they are about one-sixth the width of the postero-lateral interambulacra at the border. The poriferous zones are narrow, and extend rather more than half-way down the dorsal surface; the pairs of pores are placed closely together, and the slit or sulcus, which in general unites the inner and outer series of pores together, is absent in this species, or at all events is not apparent in the individuals before us; the holes of both rows are nearly of the same size. The interambulacral areas are wide; the antero-lateral are the narrowest; the single interambulacrum is slightly produced in the region of the anal opening. The apical disc is small, and situated near the centre of the test, rather nearer the anterior than the posterior border. The disc consists of a central madreporiform spongy body, around which the genital and ocular plates are arranged in a circle; their sutural lines of union, however, are concealed, and can only be seen in weathered specimens. The base is convex; the mouth is very large, and lies in a deep depression opposite the vertex; it is surrounded with five oral lobes of small size, with intervening petaloidal depressions, perforated with holes in pairs. The interambulacrum is slightly produced posteriorly. The anus is a large transversely oblong opening, situated near the margin. The border of the test is rather obtuse. The tubercles are of uniform size on the dorsum, and are larger and less numerous than in *E. Kleinii*.

Affinities and differences.—This species resembles much *E. scutiformis*, but is distinguished from it by the greater narrowness of the ambulacral areas, and the absence of the transverse slits or sulci by which the pairs of pores in these avenues are in general united. The tubercles are more abundant on the dorsal surface in *E. Deshayesii*, and the dorsal surface is not so much elevated in that species as it is in *E. scutiformis*.

Locality and stratigraphical range.—This species was collected from bed No. 2, the yellow sand, at Malta. Desor gives the "Tert. moyen. d'Oran (Algérie) et de Carthagène (Catalogue)" as his localities; and we have received from M. Michelin of Paris a specimen from the Miocene terrain of Balistro, Corsica, which has enabled us to identify the Maltese Urchin, and make out the preceding description, the first given of this pretty form.

Echinolampas Richardi, Desmarest.

Syn. *Scutum ovatum Issyaviense*, Klein, Echinodermatum, tab. 20. fig. *a*, *b*, § 77. p. 29 (?).

Clypeaster Richardi, Desm. Dict. Sc. Nat. t. liv. tab. 5. p. 12, spec. ined. in litt.; Grateloup, Mem. Echid. Foss. tab. 1. fig. 8 *a*, *b*, p. 44.

Echinolampas Richardi, Desmoulins, Etudes sur les Echinides, p. 342. no. 4.

Echinolampas Laurillardi, Agassiz and Desor, Ann. Sc. Nat. t. vii. p. 165.—Scilla, Corp. Mar. tab. 11, top figure, showing the base only.

Test oblong, produced posteriorly, rounded before, flattened laterally, caudate posteriorly; dorsal surface convex, elevated; base concave; mouth central; anus inframarginal, lodged in a caudal process of the interambulacrum; ambulacral areas narrow, with contracted poriferous zones.

Dimensions.—Antero-posterior diameter $1\frac{7}{10}$ inch, transverse diameter $1\frac{9}{20}$ inch, height $\frac{17}{20}$ths of an inch.

Description.—The specimen before us is so much injured on the dorsal surface, that we are unable to give a detailed description of this species, which appears to be not uncommon at Malta. The ambulacral areas are narrow; the pores lie in contracted zones, and the pairs are unconnected by sulci; the avenues extend more than half-way down the sides of the test; the dorsal surface is elevated and convex, rounded before, and sloping gradually from the vertex to the posterior border; the apical disc is very excentrical, and placed near the anterior border; the circumference of the test is of an irregular oblong figure, round before, flattened on the sides, and produced behind. the base is undulated by the elevations of the interambulacra and the depressions of the ambulacral areas; the single interambulacrum is prolonged backwards, and is truncated at the sides and at the posterior border, which gives it a caudate form. The mouth is nearly central, and is sunk in a deep depression; it is transversely oblong, and is surrounded by five oral lobes, having five petaloidal depressions of the ambulacral areas, with three pairs of pores in each petal between them; the anus is larger than the mouth-opening, and is situated at the inframarginal border of the caudate process of the interambulacrum; it has a transversely oblong form, and is more convex before than behind. The Urchin figured by Grateloup is much larger than the Maltese specimens that have come under our notice; but the central mouth-opening and the form of the interambulacrum induce us to think that it is only a gigantic variety of *E. Richardi,* and not *E. Kleinii,* as supposed by Desmoulins. The identity of this species with Klein's *Scutum ovatum Issyaviense* may or may not be correct, as the figures of fossils in that work are not in every case to be depended on.

Affinities and differences.—*E. Richardi* has some resemblance to *E. Kleinii,* but the narrow ambulacral areas, the flattened sides, and produced caudate interambulacrum in *E. Richardi* afford points of distinction by which these allied forms may be readily distinguished from each other. In *E. Kleinii* the base is more concave, the mouth nearer the anterior border, and with larger oral lobes than in *E. Richardi.* The dorsal surface presents other points of difference: in *E. Kleinii* the posterior half of the test is the most elevated, whilst in *E. Richardi* it slopes rather abruptly downwards from the vertex to the truncated posterior border.

Locality and stratigraphical range.—It was collected from bed No. 2, at Malta; the specimen before us is the only one in Earl Ducie's cabinet. The Geological Museum in Jermyn Street possesses an interesting series of this form, which are all from the same island. Grateloup found the large variety at Dax, in the "faluns bleus de Narrosse," and adds that it is found likewise at Paris, Montpellier ?, Bordeaux, and the Vicentin · Desmoulins adds St. Paul-trois-Châteaux (Drome) as another locality.

Genus CONOCLYPUS (Agassiz, 1839).

Test thick, hemispherical or oval, and always much elevated; ambulacral areas above long, wide, converging at the summit, a little contracted below; mouth median, symmetrical, pentagonal, and surrounded by five large lobes; base flat, basal portion of the ambulacra with poriferous zones around the mouth-opening; anus inframarginal, sometimes transversely oblong. The species are all fossil, and belong mostly to the tertiary rocks: one is found in the Maestricht chalk. This genus is nearly allied to *Echinolampas.* The character upon which M. Agassiz relied as diagnostic between *Conoclypus* and that genus, the direction of the anus, which is stated* to be elongated in the antero-posterior diameter in *Conoclypus,* and in the transverse diameter in *Echinolampas,* does not hold good in all the species.

Conoclypus plagiosomus, Agassiz.

SYN. *Conocyplus plagiosomus,* Agassiz and Desor, Cat. rais., Ann. Sc. Nat. 3rd series, tom. vii. p. 168.

Test thick, large, highly convex; border acute; outline round,

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* Ann. Sc. Nat. tom. vii. p. 167.

inclining to oblong, being slightly compressed on the sides; ambulacral areas narrow, even with the interambulacra; poriferous zones very narrow; the inner and outer pores nearly equal in size, and extending through three-fourths of the areas; base concave; mouth nearly central, with large oral lobes; anus large, transversely oblong and inframarginal.

Dimensions.—Antero-posterior diameter 6 inches, transverse diameter 5$\frac{9}{10}$ inches, height 3 inches.

Description.—This noble Urchin has been mistaken for *C. conoideus*, Lamk., as in form, size, and some of its general characters it resembles that type species; but the eye of the practised zoophytologist detects, in the structure and narrowness of the poriferous zones, an organic character sufficient to enable him to separate it from that species. The general outline of the base is round, inclining to oval from the gentle compression of the sides thereof; the dorsal surface is much elevated and highly convex, and the vertex is situated in front of the centre of the dome; the ambulacral areas are nearly one-fourth the width of the interambulacral areas at the border, and are level with them; they are nearly of a uniform width throughout, becoming lanceolate at their upper fifth: the poriferous avenues are very narrow, and extend three-fourths of the distance between the apex and the border: the pores in the avenues are only about one line apart, and are united by short slits directed obliquely upwards and inwards at nearly equal spaces apart from the base to the apex; the pores in the outer and inner series in each zone are about the same size throughout: the narrowness of the poriferous avenues forms a very important character in this species, by which it is distinguished from an allied form, *C. conoideus*. The interambulacra are of a triangular form; the antero-lateral are the smallest, and the postero-lateral and single interambulacrum of about the same size are the largest: the apical disc is small, and situated nearer the anterior than the posterior border, which occasions a slight difference between the angle of inclination of the anterior and posterior sides of the test: the centre of the disc is occupied by a prominent button-like spongy madreporiform body, around which the genital and ocular plates are arranged, but their lines of suture can only be distinguished in weathered specimens, or by removing the superficial layer of the plates. The entire surface of both areas is covered with tubercles, very much alike both as regards size, form, and irregularity of arrangement; the only parts exempt from tubercles are the interporiferous septas of the avenues: the base is concave: the mouth is situated in the centre of the disc, and is surrounded by five large prominent lobes: the ambulacra form petaloid depressions between the oral lobes, in which a number of pores are clustered together in pairs. The anus is a large, transversely oblong opening, placed immediately beneath the posterior margin; from it to the mouth an elevated ridge of the test runs: the single interambulacrum is slightly produced posteriorly where the anus teminates: the tubercles are larger, and placed at greater intervals apart on the base than on the dorsal surface: the marginal fold of the test forms an acute angle, and on the border thereof the tubercles are clustered closer together in greater numbers, with smaller interspaces between them, than in any other part of the skeleton.

Affinities and differences.—This species very much resembles in form and size *C. conoideus*, but it is readily distinguished from it by the following characters: the ambulacral areas are smaller, the poriferous zones are narrower, and the outer and inner pores of each pair are nearly of the same size, whilst the septas between the pores are thicker; the dorsal surface is not so much elevated, the base is concave, the anus is large and transversely oblong, and the mouth possesses very prominent oral lobes.

Locality and stratigraphical range.—This Urchin was collected at Malta, from bed No. 2. The fine specimen before us belongs to the Bristol Institution; we possess one, through the kindness of M. Michelin, from the celebrated Urchin bed of Balistro (Corsica); it is found likewise in the "Molasse du Cap Couronne près Martigues." (*Michelin.*)

[To be continued.]

XIII.—*Notes on British Zoophytes, with descriptions of new species.* By the Rev. Thomas Hincks, B.A.

[With two Plates.]

New species of Sertularia.

The beautiful form which I am about to describe has hitherto been found, so far as I am aware, only in the Shetland seas. Two specimens in fine condition, and fortunately laden with vesicles, were obtained by Miss Cutler amongst the refuse of Mr. Barlee's dredge. To her great liberality I am indebted for one of these specimens (as for many other interesting zoophytes), and for the opportunity of presenting a figure and description of the species to the readers of the 'Annals.'

Genus Sertularia.

S. alata (Hincks).

Pinnate, blackish-brown, highly varnished; *pinnæ* winged; *cells* opposite, adherent below, the upper part suddenly divergent, wide, compressed, concave above, with an oblong aperture. *Vesicles* small, quadrangular above, with a mucro at each corner on the top, and a raised, circular orifice in the centre.

Polypidom from 3 to 5 inches in height, simply pinnate, of a rich blackish-brown colour, and very highly varnished; *pinnæ* alternate, slender towards the base, often much elongated, winged or keeled along one side; *cells* opposite, adherent for about half their length, and then suddenly divergent,—the upper part wide, compressed, rounded below, the superior surface concave, the sides deeply indented,—aperture oblong, the outer margin everted, the inner sinuated. *Vesicles* small, set along one side of the pinnæ, attenuated towards the base, subquadrangular above, —a mucro (which bends inward) at each corner, and a raised circular orifice in the centre.

The vesicle bears considerable resemblance to that of *S. pinaster*, as figured by Dr. Johnston.

Sertularia alata is nearly allied to the *S. mutulata*, described by Mr. Busk in the 'Voyage of the Rattlesnake,' and a native of Torres Straits*. Besides other differences, however, the vesicles of the two species are perfectly dissimilar,—that of the *S. mutulata* being aculeate.

Hab. Shetland. (Plate II.)

NEW POLYZOON.

A very minute zoophyte has occurred to me, creeping over the surface of large mussel-shells brought in from the Dogger Bank to the Yorkshire coast, which has hitherto escaped notice. I have not yet had the opportunity of examining it in a living state, but I have little doubt that it is a Polyzoon, and shall assign it a place provisionally as such.

Family *Eucratiadæ*, Johnston.
„ *Scrupariadæ*, Busk.

Genus HALIA (Hincks).

Polypidom adherent, creeping, corneous, branched; *cells* decumbent, adnate, irregularly disposed along the fibre, to which they are attached at the base, or by a short stalk.

Species: *Halia prætenuis* (Hincks).

Cells elongate, with upturned, terminal, and more or less tubular apertures.

The *polypidom* is a creeping fibre of great delicacy, irregularly branched, corneous and closely adherent; the *cells*, which occur sometimes in pairs, one on each side of the fibre, sometimes singly, sometimes in companies, are elongate, attached by a short stalk, adnate, except at the anterior extremity, which bends upward, and terminates in a roundish aperture. They are commonly laid alongside the fibre, and often appressed to it, but occasionally stand out from it.

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* I am much indebted to Mr. Busk for his kindness in comparing the Shetland *Sertularia* with the foreign species of the same genus.

Hab. Mussel-shells from the Dogger Bank. (Plate III.)

CELLULARIA CUSPIDATA (Busk),—a British species.

Mrs. Gulson has kindly supplied me with a specimen of this *Cellularia*, which she obtained from the refuse of one of the Brixham trawl-boats. It is a well-marked species, allied to *C. Peachii*, and is common in Australia. Collectors in the South should be on the look-out for it. Like the *Caberea Boryi* (Busk), it may prove, when attention is directed to it, to be far from uncommon.

There is a description and figure of *C. cuspidata* in Mr. Busk's 'Catalogue of the Polyzoa in the British Museum.'

CABEREA BORYI.

Of this exquisite species, which is one of the latest additions to our fauna, I have been fortunate enough to procure several small tufts during the past autumn. They were dredged off Budleigh Salterton (Devon), on much the same ground as yielded Miss Cutler's beautiful specimen—the first recorded as British. They were, for the most part, growing in the midst of a mass of *Scrupocellaria scruposa*. The species being small, and bearing a general resemblance to some of the commoner members of its tribe, may readily escape detection, but it seems probable that, at least on the Devonshire coast, it is far from rare.

BEANIA MIRABILIS,—the POLYPE.

The Polype of this species is, I believe, as yet undescribed. It has about twenty long and delicate arms, forming a singularly graceful bell, slightly everted round the rim. When fully extended, it protrudes very far beyond the orifice,—the body at such times only occupying about the upper third of the cell. A long, straight œsophagus leads from the pharynx to the stomach. The flexible portion of the cell, which unrolls as the animal issues (and which has no operculum of *setæ*), is of remarkable length. Amongst the Polyzoa I know of no polype which excels this in beauty, unless it be that of the (so-called) *Flustra hispida*. An examination of its structure justifies Mr. Busk's removal of the genus *Beania* from the family of the *Vesiculariadæ*.

I have procured the *B. mirabilis* in a living state, parasitic on *Cellularia avicularia*—one of Mr. Bean's original habitats for it—in tide-pools on the Devonshire coast.

LAOMEDEA LACERATA (mihi).

This species (the perfect state of Dr. Johnston's *Campanularia lacerata*), which I first described in the 'Annals' for August 1852, has occurred to me again on the coast of Devon. It has a special liking for *Bowerbankia imbricata*, about the dense tufts of which I have found it in considerable plenty at Exmouth, and I have also dredged it in Slapton Bay, on *Campanularia verticillata*.

CAMPANULARIA INTEGRA,—the VESICLE.

We have no description or figure, I believe, of the *Vesicle* of this species, though it may perhaps be known to collectors. I have only once met with it,—on specimens of the zoophyte found at Filey on the Yorkshire coast, which spread profusely over one of the red sea-weeds,—a favourite habitat with the various kinds of *Campanularia*. The vesicle of *C. integra* resembles in general character that of its ally the *C. volubilis*, but has its own distinctive peculiarities. It is more truly pedicellate, elongate, spirally twisted, the wrinkles are not so numerous nor so closely set, and are sharply carinated The vesicle is abruptly attenuated below, and wants altogether the regular ovate form which belongs to that of the *volubilis*.

I am glad to be able to add a drawing of the *C. integra* and its vesicle, from the accurate pencil of Mr. Tuffen West. Plate III.

EXPLANATION OF PLATES II. AND III.

PLATE II.

Sertularia alata, natural size, and portions magnified.

PLATE III.

Halia prætenuis, a few cells magnified.
Campanularia integra, with its vesicles, magnified.

XIV.—*On the Marine Vivarium.* By C. S. HARRIS, Esq.

To the Editors of the Annals of Natural History.

GENTLEMEN,

THE accompanying letter was sent to me a short time since by my friend C. S. Harris, Esq., of Budleigh Salterton, Devon, whose experience has been equal to that of either Mr. Warington or Mr. Gosse, but scarcely with the same result; unless, as I may infer from the following paragraph in Mr. Gosse's last communication to the 'Annals'—"Some of the original animals still remain in a healthy condition, such as *Actiniæ* and *Serpulæ*, though others have died off in the course of the summer, and have been replaced by more"—Mr. Harris changed the water, Mr. Gosse the animals.

My own experience is limited to this summer, and certainly through the hot weather we could not keep animals alive, except some common *Actiniæ*, which shut themselves up into balls: unless the water was changed every few days, it became brown. But since the weather has become colder, I have kept many animals, including *Aplysia*, *Actiniæ* (several species), *Paguri*, *Dorides*, Mollusca, and one large Starfish (*Uraster glacialis*), for four months, when an accident broke the case, of which we have three mounted in the garden of the Athenæum here:—the object of which, in this approximity to the sea, is more to have a reservoir to observe oceanic products, than to prove the capability of maintaining a perpetual and healthy equilibrium between the animal and vegetable kingdoms; though the latter will not be neglected.

The fact observed by Mr Warington, of the power of the *Limnæus* to move from one place to another by means of a mucous suspending cord, I have observed also to be the case with *Bulla aperta*, in the vivarium of my friend Mr. Smyth; but the power of secreting the mucus, which is exuded from the external surface of the animal, is limited in its continuance; to prove the fact, we raised it three times to a glass shelf in the vivarium; the last time, not being able to secrete the ladder, it fell head over heels, and therefore lost the power of choosing its place below, as it could do when it came down by the cord.

I am, Gentlemen, yours obediently,

C. Spence Bate,

Hon. Sec. to Plymouth Institution and Devon and Cornwall Nat. Hist. Society.

17 Clarence Place, Penzance, Dec. 17, 1854.

My dear Sir,

In answer to your request, I have only to say, I did not keep a vivarium with any view to its being of service to the cause of science; not having, at the time I commenced some five years ago, any idea that others were doing the same with a higher view than mere amusement: this I now very much regret; however, such experience as I have had shall be detailed as briefly as possible, and if of any service to you, I shall feel gratified by your using it. At first I put into the tank (a long glass case, length 2½ ft., depth 18 inches, width 12 in.; the bottom of 3-inch mahogany, with a gutta-percha tap to draw off the water) all the curious objects that presented themselves in my dredging, and for some time derived much pleasure in watching them; but I soon found that crowding was not only injurious to the various tribes, but that it caused the water to become foul.

The *Actinia dianthus*, *A. parasitica*, *A. crassicornis*, I have found the longest lived; *dianthus* I have 3½ years old, and some 2 years old, born in the tank. this species I have never yet found take any food I offered, therefore I suppose it derives its nourishment from animalculæ; it is the best for keeping and the most beautiful, standing up some 6 to 9 inches; the others I occasionally fed with a portion of mussel, previously washed, to destroy the milky substance that would foul the water. With these live very well the small Hermit Crabs and Swimmers (crabs), also the Rock Blennies; the latter I have had tame enough to come to the surface and feed from the hand; I kept them five months, when they were destroyed by my crowding in too many things, with the desire to show a friend. I have found it advisable to clean all the *Actiniæ* previous to placing them in the tank, by keeping them in a tub of salt water, and taking off the dirt and slime with a soft brush; they will then throw out a quantity of milky liquor, which, if in the vivarium, would foul it. As a rule, I clean everything and keep it apart for a few hours to get purged, fish excepted. All the Pectens are amusing, and tolerably long-lived. The Goby is a long liver also. The *Sertulariæ* are beautiful objects. *Tubularia gracilis*, *T. indivisa*, *Lucernaria auricula*, *L. campanulata*, are all beautiful, and when near the glass and viewed with a lens, highly interesting; they do not foul the water if taken out when dead. All the above have been in one tank, the water of which in winter was changed once in two or three weeks, in summer twice a week. Growing on pieces of rock were *Iridæa edulis*, *Enteromorpha erecta*, and *E. intestinalis*; these all kept well. I was much troubled with a green weed, which *during the summer* months covered everything, and could only be kept down by a thorough cleaning every week; but in one experiment I made with some water left a whole summer in a globe, this green weed (I think an *Enteromorpha*) kept the water perfectly sweet: this globe was placed out of the influence of the sun, but open to the rain. Another beautiful object, but which, unless the water is frequently changed, continues in beauty but a few days, is the *Alcyonium digitatum*; nothing can be more beautiful when fully distended. I have kept them eight to ten days by frequent changes of water, as they are apt to turn it milky, which is certain destruction to all in the tank; they are very abundant, and make a fine show among a group of common *Actiniæ*.

I never found that the green plague could be kept down by the introduction of the common Winkle, or other Mollusca. It is, however, highly interesting to see the latter deposit their spawn; and moreover the *Trochi* and others are very beautiful. One very interesting fact I witnessed several times: the *Gonoderus* (I know not the specific name) deposit its spawn, in the form of a mass that I can compare to nothing better than a shirt frill, and always quite at the edge of the water. I had two in the vivarium: when one, which I suppose to be the female, had deposited its spawn, the other took its place close by, as if to guard it. I removed them several times to the opposite end, but they could be seen as constantly returning to the same spot · as they chose such an unsafe place, I had no opportunity of seeing the result of their labours come into life.

The *Actinia dianthus* will appear sometimes covered with a thread-like mucilage, which in a few days shows small joints or knobs; these begin to wave or float about and attach themselves to the glass, or shells and rock, and in a day or two, if examined with a lens, will be found to be the young *Actiniæ*; therefore with common care you need not be without this lovely variety, which in fact gives no trouble.

It is only within the past two years that I have heard of attempts to keep sea water pure by means of certain sea-weeds; but I must confess that all the vivaria I have seen since, where the attempt has been made, have been anything but pleasant sights to look upon,—not in the least resembling the clear rock-pools one delights to pry into on a bright summer's day. Whether such a desirable thing will ever be accomplished, is a question far from being solved; I have made two or three attempts, at the suggestion of others, but without success. In warm weather up rose that plague, the little green weed, and soon hid everything from sight; thus destroying the use of the vivarium as an object of study or delight, though by it the water might be kept pure,—but how far animal life also, I know not. I certainly think, as a public sight, instructive and entertaining, the vivarium is best kept in order by manual labour, changing the water, cleaning the animals, rocks and shells, and removing instantly all that perish. An hour or so in early morning is all that is required, with the introduction of a few new or fresh objects from time to time; and by occasionally changing the masses of rock,—from which change you would get much proper food for your animals,—all would be kept in a healthy condition In large tanks larger rock-fish may be admitted; but, I think, as a rule, all that have a tendency to foul the water should be kept apart, among which are those animals that require much feeding; though none require much, if the water is properly changed and a spare tub of water kept for cleansing purposes.

A very beautiful vivarium might be made, having on rocks and shells as many varieties of zoophytes as could be procured, the only large objects to be the *A. dianthus*, which requires no feeding, and is found of such beautiful colours; the *Delesseria* and other striking Algæ might be introduced with effect, and I will vouch for its attraction.

Were I nearer to you, I should have much pleasure in being at your meetings. I have written to a friend dredging in Scotland to send home all the small Crustacea, among which you may possibly find something.

Yours very sincerely,
C. S. Harris.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

January 11, 1853.—Dr. J. E. Gray, V.P., in the Chair.

On a New Species of Salamander from California. By J E. Gray, Ph.D., F.R.S., V P.Z S.

Mr. Henry Gurney most kindly sent to the Zoological Society for exhibition some Reptiles, from Monterey in California, with the desire that the specimens should afterwards be placed in the British Museum. Among the rest was a very fine and large specimen of a Triton, which has much the external appearance of the large white-spotted *Ambyostoma Carolinæ* of the eastern part of the United States of America. On more minute examination and comparison, it proved to be quite distinct; and as I do not find any description of it in any of the American papers on these animals, I have sent a comparative description of the two species.

1. Ambyostoma Carolinæ, Gray, Cat. Amph. B. M. 35.

Brown, small spot over orbit, large spot on each side the occiput, on each leg near the joint, and a series down each side of the back and tail, white; palatine teeth in a short, nearly straight line, between and not reaching to the internal nostrils, and with a separate small group of teeth behind each internal nostril.

2. Ambyostoma Californiense.

Black; sides of lips, lower part of neck, body and tail, and limbs, with large white spots; palatine teeth in an elongated angular transverse line, bent forwards in the middle and extending to the outer edge of the hinder part of the internal nostril.

Hab. California, Monterey, in a well (*Gurney*).

A smaller white spot on each side of the back, not symmetrical; the one on the right side being much in front of the other.

Ambyostoma punctulatum, Gray, Cat. Amph. B. M. 37, has the tongue free on the side, and is nearly allied to the genus *Plethodon*: the palatine teeth are very indistinct, not forming a regular ridge.

Description of a New Species of Tortoise (Testudo planiceps), from the Galapagos Islands.

By J. E. Gray, Ph.D., F.R.S., V.P.Z.S., P B.S. etc.

After the examination of the specimens of the large Black Tortoise (*Testudo Indica*) in the various English and continental collections, including the specimens which had served Schweiger, Schlegel, Fitzinger, Dumeril and Bibron, and others, as the types of species, I placed them all in the 'Catalogue of the Tortoises, Crocodiles and Amphisbænians in the Collection of the British Museum,' as varieties of a single, very variable species, which had been scattered by man in different tropical parts of the globe. I see no cause to change my opinion with respect to the head now about to be described, even should it prove to be that of a black species, which is possible, as the black species is the only one known which has any affinity to it in point of size. The skull now described was sent to Haslar Hospital, and said to have been taken from a specimen brought from the Galapagos Islands. The Black Tortoise of those islands has been described by Dr. Harlan under the name of *Testudo elephantopus*, but his figure and description so exactly agree with the adult *Testudo Indica*, and the specimen in the Gardens of the Zoological Society brought from the Galapagos Islands, is so exactly similar to the specimen of *Testudo Indica* from the Mauritius, that I cannot think that the usual Galapagos Tortoise is different from that species, or like the skull here noticed. I therefore propose to designate this species by the provisional name of *Testudo planiceps*. The following comparative statement of the characters presented by this skull and that of *T. Indica*, will show the differences which exist between them

TESTUDO INDICA	TESTUDO PLANICEPS
Skull high, convex.	Skull much-depressed, flat.
Forehead convex, rounded to the nose-cavity; broad between the eyes.	Forehead flat, with a rapid declivity towards the nose-cavity, narrow between the eyes
Temples flat behind.	Temples produced, bent in behind.
Cheeks small, four-sided.	Cheeks large, subtrigonal.
Edge of the jaw between the nose-cavity and the mouth narrow and rounded.	Edge of the jaw between the nose-cavity and the mouth high and erect.
Nose-cavity oblong, nearly twice as high as broad, contracted on each side above.	Nose-cavity nearly square, scarcely higher than broad, and very little contracted above.
Palate broad, oblong, very deeply concave, and with concave converging sides in front.	Palate narrow, nearly lozenge-shaped, truncated behind, rather deeply concave, with straight converging sides in front.

TESTUDO INDICA.	TESTUDO PLANICEPS.
Sphenoid bone deeply concave beneath, under the condyle.	Sphenoid bone flat beneath, under the condyle.
Lower jaw narrowed and rounded in front, not more than half as high as behind.	Lower jaw convex and erect in front, and as high as behind.

These descriptions are taken from skulls of nearly the same size, as proved by the following measurements:—

	T. Indica.	*T planiceps*
Length from condyle to front of lip	$5\frac{3}{8}$	$5\frac{1}{8}$
——— from occipital crest to nose-cavity .	$5\frac{2}{8}$	$5\frac{6}{8}$
——— of palate concavity .	$3\frac{3}{8}$	$2\frac{6}{8}$
Width at condyles .	4	$4\frac{1}{8}$
——— at ends of temporal bones .	$4\frac{1}{8}$	$3\frac{7}{8}$
——— of palate concavity in middle	$1\frac{3}{8}$	1
——— between orbits . . .	2	$1\frac{3}{8}$
Height from back of upper lip to top of head	$2\frac{5}{8}$	$1\frac{6}{8}$
——— of front of lower jaw	$\frac{5}{8}$	1
Length of nasal opening . .	2	$1\frac{1}{16}$

January 25.—Dr. Gray, F.R.S., Vice-President, in the Chair.

DESCRIPTIONS OF TWO NEW BIRDS, FROM FERNANDO PO.

BY LOUIS FRASER.

BUBO POENSIS, Fraser.

Brownish yellow, each feather barred with brown, the brown predominating on the crown, shoulders and middle of the back, tail above barred with brown and greyish brown alternately; twelve bars of each colour.

Total length 16 inches; gape, $1\frac{3}{8}$; wing, 12; tail, 7, tarsi, $1\frac{3}{4}$.

Hab. Fernando Po.

Killed in June. The specimen from which the above description was taken is the only one that has been seen by the town's-people, consequently I presume it is very scarce, at least in this part (Clarence) of the island. The natives say it destroys fowls, which here roost in the trees.

Native name 'Oko.' This is evidently a generic term, as the same name is applied to my *Strix Poensis.*

BUCEROS POENSIS, Fraser.

Female by dissection. Head and neck maroon, the feathers of the head standing out in apparent disorder, as in *Buceros comatus*, the rest of the plumage black, the back and tail having bronze reflections, the four outer tail-feathers terminated with white.

Cere cæruleau-blue; upper part of throat-sac French-white, middle a blending of French-white and blue, terminated with cæruleau-blue; these fleshy parts are much wrinkled; legs and feet deep blue.

Total length 30 inches, gape, 6; wing, $14\frac{1}{2}$; tail, 13; tarsi, $1\frac{3}{4}$.

Hab. Fernando Po.

Killed in the month of July, in deep moult.

Native name, 'Oon-cot-to.' The natives say it cries, as it flies, 'How-oo-ar, how-oo-ar, how-oo-ar.' Very shy. Makes its nest in holes of very large trees, in the dry season; lays two eggs. These birds used to be common in the neighbourhood of Clarence, but since the introduction of guns they have been much shot, and have retired to the mountain.

Palm oil nuts, only, were found in the gizzard, which was soft, almost like a stomach; skin very thin and difficult to prepare. Between the skin and body appeared to be air-cells.

The male is said to differ materially, but I have not been fortunate enough to procure a specimen.

February 8.—John Gould, Esq., F.R.S., in the Chair.

MONOGRAPH OF THE GENUS ÆGOSOMA, SERVILLE, WITH THE DESCRIPTION OF A NEW GENUS AND SPECIES ALLIED TO IT.

BY ADAM WHITE, F.L S.

The genus *Ægosoma* was formed by M. Serville for the reception of a longicorn beetle, first described by Scopoli under the name of *Cerambyx scabricornis*. In this genus the head is produced behind the eyes into a kind of neck, unlike its congeners, which have the head retracted into the thorax as far as the eyes. The prothorax is trapezoidal and contracted in front, the ovipositor of the female is long and prominent; the antennæ in the males are rough, in the females smooth.

The larva of the European species is found in the trunks of various kinds of trees; the perfect insect, according to M. Mulsant, appears at Lyons in the month of July, and is active at night M. Serville alludes to a second species, which he had seen in the collection of M. Dejean, where it bore the name *Æg affine*. In the following little monograph will be found descriptions of five new species, all contained in the collection of the British Museum.

ÆGOSOMA.

Ægosoma, Serv. Ann. Soc. Ent. Fr. i. 162.—*Cerambyx*, p. Scop.—*Prionus*, p. Fabr.

1. ÆGOSOMA SCABRICORNE.

Cerambyx scabricornis, Scop. Ent. Carn. 54.

Prionus scabricornis, Fabr. Syst. El. ii. 258, Oliv. Col. iv. t. 11. f. 42. ♀; Latr. R. A. v. p. 108.

Ægosoma scabricorne, Serv. Ann. Soc. Ent. Fr. i. 163, Mulsant, Col. de France, i. p. 24.

Hab. Europe. Coll. Brit. Mus.

2. ÆGOSOMA SINICUM, White. *Æg. nigro-brunneum, thorace medio postice recto, scutello apice subelongato.*—Long. lin. 18.

Hab. Shanghai, N. China (*Mr. Fortune*). Coll. Brit. Mus.

There is a female of this species in the Museum; it comes from Shanghai, and differs but little from the corresponding sex of the *Ægosoma scabricorne*; it is of a darker brown, the posterior margin of the thorax over the scutellum is straight, and not slightly notched as in that species; the scutellum also is more pointed.

3. ÆGOSOMA ORNATICOLLE, White. *Æg. capite et thorace nigris, verrucis minutis scabriusculis; thorace plagis quatuor pilis aureis tectis, elytris obscure ferrugineo-brunneis, sutura (apice spinigera) margineque nigris, antennarum articulis tertio quarto et quinto basi asperis.*—Long. lin. 25

Hab. E. Indies Coll Brit. Mus.

Head black, covered with small warts, with a smooth line down the middle, ending in a small smooth depression in the space between the antennæ. Mandibles strongly punctured, tips and inner edge smooth: antennæ with the basal joint thickly covered with small warts; the third, fourth and fifth scabrous, the projections more distant from each other than they are on the basal joint, sixth and following joints short and smooth. Thorax thickly covered with small warts, with four small spots covered with golden yellow hairs; two of these spots on the fore-margin, two on the posterior margin, somewhat more distant from each other than the two fore ones, the hairs are all more or less directed towards the centre of the spot. Elytra smooth, dull ferruginous brown, the suture and margins black, the suture spined at the apex

4. ÆGOSOMA MARGINALE.

Cerambyx marginalis, Fabr. Syst. El. ii. 280.

Hab China, Hong Kong (*J. C. Bowring, Esq.*), Cape of Good Hope (*Fabr.*). Coll Brit. Mus.

5. ÆGOSOMA CINGALENSE, White. *Æg. antennarum articulis tertio et quarto scabriusculis et breviter pilosis; thorace spina brevi laterali, dorso excavato, elytris costatis pilisque flavescentibus tectis, sutura apice mutica.*—Long. lin. 17–20½.

Hab. Ceylon. Coll. Brit. Mus. and Capt. Parry.

Head between and behind the eyes more or less covered with decumbent yellowish hairs; antennæ with the basal joint scabrous and punctured; third joint very long, slightly curved, somewhat rough, and rather thickly covered with short yellowish hairs; fourth joint as long as the fifth and sixth joints taken together, somewhat bent, rather rough, and covered with short yellowish hairs, except at the tip, which is smooth, the fifth and following joints without hairs. Thorax with the sides angled, the angle terminating in a small sharpish spine; the posterior edge margined, middle of the back hollowed out, sides somewhat nodulose, surface punctured and more or less thickly covered with yellowish adpressed hairs. Scutellum with yellowish adpressed hairs. Elytra very long, rather flat, with two or three not very prominent costæ, and rendered less distinct by the yellowish adpressed hairs which more or less thickly cover the surface, end of the elytra gradually rounded off; suture without a spine Abdomen beneath smooth, shining. Legs compressed, somewhat scabrous, brown, with shortish yellow hairs.

6. ÆGOSOMA SULCIPENNE, White. *Æg. thoracis lateribus sub-*

parallelis ; elytris tricostatis, apice spina suturali, costis duabus interioribus post medium confluentibus, ad apicem intus curvatis ; antennis lævibus, cinnamomeis.—Long. lin. 10–11½.

Hab. E. Indies, Tenasserim (*J. D. C. Packman, Esq.*). Coll. Brit. Mus.

Head smooth, not grooved down the middle, chestnut-brown, with some scattered short yellowish hairs; antennæ smooth, cinnamon-brown, first joint strongly punctured. Thorax straight in front, the sides nearly parallel, the posterior angle somewhat projecting, the surface slightly scabrous, and rather closely covered with short golden yellow hairs. Elytra with three prominent keels, the two inner confluent beyond the middle of the elytra and continued in a single keel, which is bent inwards near the tip; the outer keel somewhat waved and slightly curved at the end, in the space between it and the other there is a shorter and less distinct keel, which about the middle of the elytra passes into small tubercles, the shoulders and sides of the keels and the spaces between them at the base are more or less covered with small tubercles, the spaces between the keels have many short golden yellow adpressed hairs. The spine at the end of the suture is sharp, as is the outer margin of the elytra. Legs compressed, brown.

7. ÆGOSOMA TIBIALE, White. *Æg. thoracis lateribus unispinosis, angulis posticis acutis, fere spinosis ; elytris lævibus, costa media distincta, alteraque ad suturam abbreviata ; suturæ apice spinoso ; tibiis crassis, tarsis angustis* —Long lin. 18½

Hab. N. India Coll. Brit. Mus.

Head short, slightly grooved between the eyes, under side of head rough. Antennæ with the first, second, third and fourth joints thickly covered with small warts Thorax with a spine on the lateral edge about the middle, separated from the produced, somewhat reflected posterior angle by a rounded sinus, surface covered with small warts and outstanding inconspicuous hairs. Scutellum punctured, with a raised line in the middle of the base. Elytra smooth, dark brown, with a distinct costa running nearly to the tip, and another between that and the suture, vanishing about the middle of the suture; elytra rounded at the tip, the suture with a short spine. Legs with the femora and tibiæ thick, the tarsi narrow.

CYRTONOPS, White, n. g.

Head with largish eyes, which are hardly if at all emarginated. Palpi long, with the terminal joint nearly twice the length of the preceding, obliquely truncated at the tip and covered on each side with shortish hairs*. Antennæ cylindrical, covered with small hairs, third joint not much longer than the fourth. Thorax rather wider than long, the sides angulated. Elytra with the sides nearly parallel. Legs simple; tibiæ compressed, and more or less thickly covered with short hairs.

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* In one of the specimens there is a curious malformation of the palpi; from the third joint proceed two longish hairy joints, one of them bent.

CYRTONOPS PUNCTIPENNIS, White. *C. brunneo-cinnamomeus, pilis brevibus erectis flavis tectus; thorace punctato; scutello pilis adpressis tecto. Elytris obscure tricostatis profunde punctatis, punctis longitudinaliter ordinatis.*—Long. lin. 9–11. *Hab.* India. Coll. Brit. Mus.

Of a rich cinnamon-brown, closely covered with short erect yellowish hairs. Thorax irregularly punctured, the punctures running into each other and sometimes leaving small smooth spaces. Scutellum rounded at the end, covered with short hairs, which lie close to the surface. Elytra with three rather indistinct longitudinal costæ; surface, except at the tip, with many deep punctures, more or less regularly arranged in lines; between these are smaller punctures, from which proceed the hairs.

EXTRACTS FROM A LETTER BY MR. H. CHURTON, RESPECTING COLLECTIONS IN NEW ZEALAND. COMMUNICATED BY MR. J. STEVENS.

Wanganui, July 24, 1851.

You can form no idea of the great trouble and expense attending a journey such as you recommend in search of the Notornis. In the first place, the nature of the country is such, that it is almost impossible to penetrate in search of anything, they can only be obtained by the merest chance, or from the natives. In most of the places where birds are to be obtained you cannot proceed without cutting your way, and the fern and shrubs are so thick and high, that if a bird rises close to you you cannot see it. This is the case with the Pakeko. I have been frequently in places abounding with them and not got a shot, though they were flying all about me, the Notornis being of similar habit will be equally difficult to obtain. In the next place, I should have to charter a small vessel for two months at least, to take tents, provisions, &c. for myself and men, to be away from home for perhaps three months, and all for the very slight chance of meeting with a very rare bird: perhaps ten years ago, when I did not mind moving, I might have gone, but now I am snug and comfortable here there is no chance of it; so for me the Notornis must remain.

There are *no positively authentic* accounts of living Moas. I have paid some attention to the subject, and have heard nothing yet *that can be relied on*. I think it possible that one species (not the largest) may yet be discovered in the Middle Island, but it will probably be some time first, as even the discovery of that bird will hardly pay a man for undergoing such fatigue and danger as would be necessary if a person went in search for it. See Mr. Brunner's journal, who was eighteen months exploring about 150 miles, and who, had it not been for his native companions, must have been starved if he had twenty lives.

The Kakapo is now pretty well known; it appears to be tolerably abundant on the Middle Island, though probably quite or nearly extinct on this. I have seen several specimens, and the Acheron steamer on her late expedition I believe obtained a great many, as well as Kiwis, so that, on her return to England, I suppose there will be plenty.

I have had *good accounts* from the natives of a very large Kiwi existing within their memory, but now supposed to be extinct on this island, it is represented as being at least four feet high. Perhaps that may be still found on the other island. There are also names for five or six other good-sized ground birds, such as large rails, &c., lately existing here, but since the introduction of so many dogs and cats, supposed to be extinct. One was shot the other day near the town, of a species of which I had seen but one specimen previously; it may be *Rallus assimilis*, but I have not the skins to compare. There is also, about thirty miles from here, a very pretty little duck or teal, which is not described. These are the only novelties I have seen since my return. I have had several Kiwis brought me, and also a few eggs; I had one for breakfast, which was very good and quite enough for one. I sent one last year to the British Museum.

I have made many inquiries about the extinct native rat, but there are certainly none now to be obtained, though formerly they were so numerous as to form a principal article in feasts, and were considered a very great delicacy; they lived on berries, &c., and were like lumps of fat; it is possible they were a kind of opossum rather than a rat. The last were seen here about ten years ago, but the cats and rats, of which the woods are now full everywhere, have destroyed them all. I think there are two kinds of native mice here; one, a sort of shrew, which my dog formerly often caught in the swamps, but which I have not seen lately, another, a little blackish one, found about fields and gardens; this one I have only seen since my return. The natives do not know it, and confound it with the common house mouse, but I do not think it can be an introduced species, as in that case it would scarcely so quickly be found in thousands over so large a tract of country as that in which it was observed last year (I have seen none lately), but rather believe it to be an indigenous species, which from some unknown cause appeared for a short time in astonishing numbers, and then as strangely disappeared.

Insects are so very few, that they are really not worth the great trouble of looking after. I have seen no new species since my return. I know of only five or six butterflies. The largest land shell *here* is a flat snail, about a quarter of an inch in diameter.

March 8.—Dr. Gray, F.R.S., Vice-President, in the Chair.

ON THE NEST AND EGGS OF MENURA ALBERTI.
BY JOHN GOULD, F.R.S.

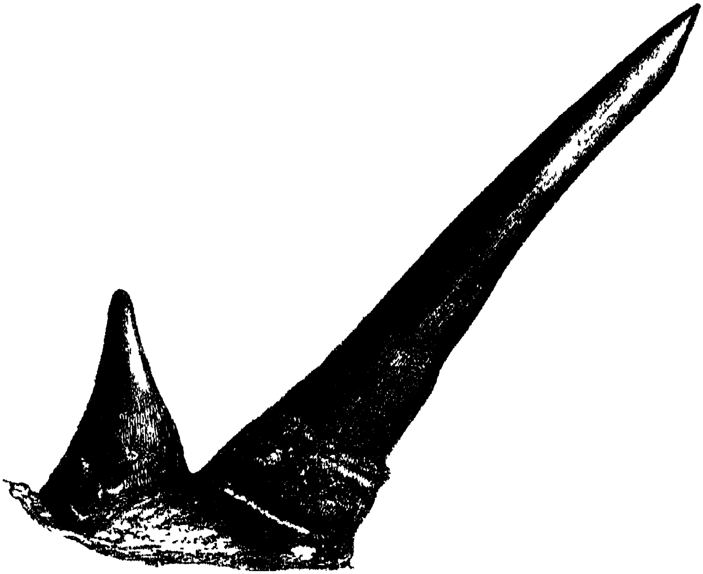
Mr. Gould exhibited a nest and two eggs of *Menura Alberti*, which had been obligingly lent to him for the purpose by Mr. Turner of Sydney. The nest was oven-shaped in form; outwardly constructed of roots, tendrils and leaves of palms, and lined with green mosses. It was about 2 feet in length by 16 inches in breadth, domed over except at one end. The eggs, barely 2¼ inches long by 1¾ broad, are of a deep purplish chocolate, irregularly blotched and freckled with a darker colour.

The nest and eggs are deposited in the national collection at the British Museum.

NOTICE OF A PRESUMED NEW SPECIES OF RHINOCEROS, FROM SOUTH AFRICA.

BY J. E. GRAY, PH. D., F. R. S., V.P.Z.S., P.B.S. ETC.

Colonel Thomas Steele having most kindly presented to the British Museum a pair of horns of a two-horned Rhinoceros, which was discovered in the interior of South Africa by his friend Mr. Oswell, Dr. Gray exhibited the horns, and having pointed out the peculiarity of their form, proposed that they should be provisionally described as belonging to a new species, under the name of *Rhinoceros Oswellii.*



The front horn is elongated and thick; but instead of being bent back, as is the general character of *R. bicornis*, or erect, as in *R. simus*, is bent forwards, so that the upper surface is worn flat by being rubbed against the ground. The front horn in the pair exhibited was 31 inches long, flat, square, rough and fibrous in front, rounded and smooth behind. The hinder horn was short, conical and subquadrangular; it was 11 inches in length.

Dr. Gray stated that the British Museum possesses a second specimen of a front horn, of a similar curve and form, with a similarly worn front top, of a rather larger size. This formerly belonged to Sir Hans Sloane's Collection; so that this species, like *R. simus*, must have been known to the older travellers.

March 22.—Dr. Gray, F.R.S., Vice-President, in the Chair.

DESCRIPTION OF A NEW SPECIES OF TETRAOGALLUS.

BY JOHN GOULD, F.R.S.

Mr. Gould laid upon the table a complete series of all the known species of the genus *Tetraogallus*, viz. the

Tetraogallus Caspius, inhabiting Astrabad, Ghilan, and other parts of Persia;
Tetraogallus Himalayensis, inhabiting the Himalaya mountains,
Tetraogallus Altaicus, inhabiting the Altai mountains,

and a fine new species, lately sent to the Honourable East India Company, from Thibet, by Captain Strachey, which he described under the name of

TETRAOGALLUS TIBETANUS.

Crown of the head, cheeks, back and sides of the neck dark slate-grey, washed with buff on the orbits; ear-coverts buffy white, chin, front of the throat and chest white; upper surface, wings and tail-coverts freckled buff, grey and black, the feathers of the middle of the back and the wing-coverts broadly edged with pale buff, rump and upper tail-coverts washed with rufous; primaries greyish brown, secondaries broadly edged and tipped with white, breast crossed by a narrow band of grey, freckled with buff and blotched with black; under surface white; the feathers of the flanks and lower part of the abdomen narrowly but conspicuously margined with jet-black, forming stripes along those parts of the body; under tail-coverts black, with a broad stripe of white down the centre; tail very dark brown, inclining to rufous at the tip; bill and feet orange-red.

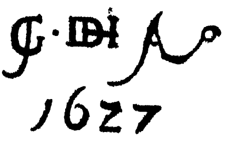
Total length about 15 inches; bill, 1½, wing, 9½; tail, 5, tarsi, 2½.

In the collection of the Honourable East India Company.

April 12.—John Gould, Esq., F.R.S., in the Chair.

NOTICE OF AN ORIGINAL PAINTING, INCLUDING A FIGURE OF THE DODO, IN THE COLLECTION OF HIS GRACE THE DUKE OF NORTHUMBERLAND, AT SION HOUSE. BY W. J. BRODERIP, V.P.Z.S., F.R.S. ETC.

Professor Owen, at whose disposal the Duke of Northumberland placed the following additional pictorial evidence of the existence of the Dodo in the seventeenth century, has requested me to draw the attention of this Society to the highly interesting picture which the Duke has been so good as to send for the inspection of the Fellows. The size of the picture, which is in the finest preservation, is thirty-two inches by nineteen. It is executed in oil, and bears the following monogram and date. Mr. William Russell, with his usual discernment, detected in this monogram the signatures of Jean Gocimare and Jean David de Heem, and proved the correctness of his judgment by a reference to Brulliot*. Jean



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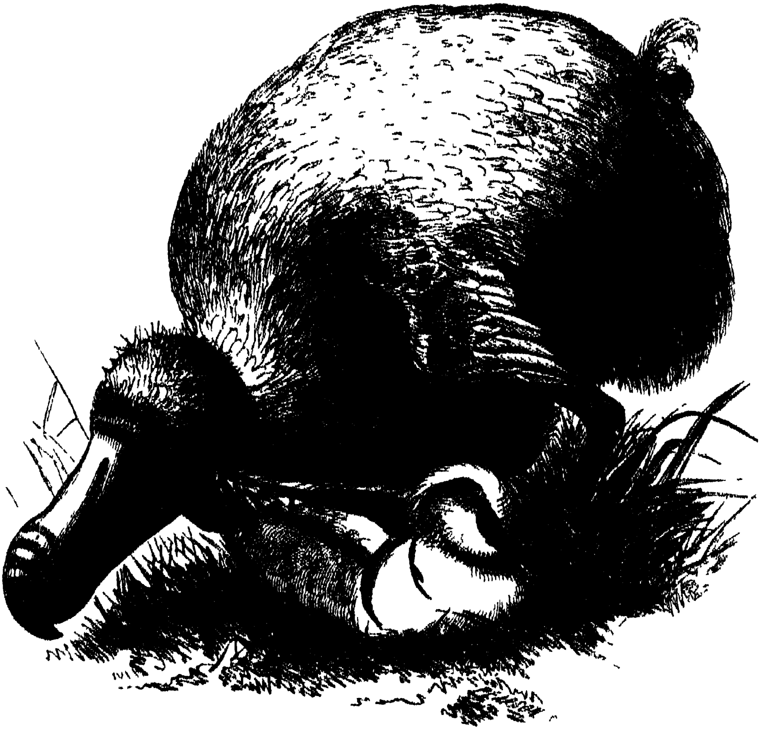
* Dict. des Monogrammes, 1 partie, pp. 274, 201.

Goeimare, who is not noticed by Descamps, Bryan, Sandrart, or Houbraken, is described by Brulliot as a Flemish artist who flourished at the commencement of the seventeenth century, and painted landscapes with many animals, executed with great care, but in rather a dry manner *. Of De Heem, the celebrated painter of still life, it would be superfluous to say anything. We may conclude, then, that in this joint production the landscape and animals were painted by Goeimare, and the shells by De Heem.



In this picture, which seems to have been intended as a record of rarities, the foreground represents a sea-shore from which the tide has retired, leaving empty shells of the following genera :—*Nautilus, Pterocera, Strombus, Triton, Pyrula, Cassis, Cypræa, Conus, Mitra, Turbo, Nerita, Mytilus, Ostrea,* &c. Behind, on elevated ground, are two ostriches, and below, to the right of the spectator, the Dodo is represented as in the act of picking up something from the strand. The head and body of the bird, covering an area as large as the palm of a man's hand, are seen, but the legs are hidden. The painter of the Dodo in *my* picture, has given the only complete foreshortened back view of the bird known to me. In the Duke's picture the head and body are presented to the spectator on a larger scale, and I have nowhere seen the hood or ridge at the base of the bill, from which the bird obtained the name of *Cygnus cucullatus*, so clearly represented. Near the Dodo are a smew and other aquatic birds, and further off hoopers and terns. In the distance is the ocean, with a sea-monster awaiting the attack of Perseus, who descends on a winged steed to the rescue of Andromeda chained to a rock. Those who have had occasion to describe and figure new species of Testacea, know how difficult it is to find a draughtsman who can give a correct design of the shell to be represented. Unless the artist, like Mr G. B. Sowerby, jun., is aware of the internal structure of the shell, and acquainted with its organization, a lamentable failure is generally the result. In the picture before us, with one exception—and even in that the specimen may have been distorted—so accurate was the eye of the painter, that if he had been aware of the organization of each shell—knowledge which he probably had not—he could not have represented the objects more correctly. The *Nautili* *, *Strombus gigas*, *Triton*, and *Pyrula*, are painted with great breadth and power, and all are drawn and coloured with wonderful truth, indeed a conchologist may name every species. One of the *Nautili* is partially uncoated, to show the nacre, and the other dissected, to display the concamerations. None of the shells have the epidermis, and all are of the natural size. The artificial condition of these subjects, and especially of the *Nautili*, is, it must be allowed, rather out of place in an assemblage of testaceans left on the sands by the retired tide, unless we are to suppose that the sea-nymphs had been amusing themselves by polishing the specimens and displaying the internal structure of one of them, but this very treatment shows that the designs were accurately made from real objects then considered as rarities. With the exception of the Dodo, none of the natural objects represented are now rare. The shells, especially those whose *habitats* are the seas of the Antilles, are at present very common; but at the date of the picture—the second year of the reign of our first Charles—the natural productions of the West Indies were not well known, and were, comparatively, very scarce. With the shells on the shore is the cranium of a carnivorous quadruped, apparently of the family *Canidæ*. The monster-cetacean in the distance has evidently no chance with the avenger who is coming down upon him mounted on a winged steed. But Pegasus, who, with other prodigies, sprang from the blood that dropped from Medusa's head, as the conqueror who had cut it off with his harpe traversed the air with his gory trophy, immediately winged its flight to Helicon, there to become the pet of the Muses. The best version of this mythological story relates that when Perseus afterwards killed the sea-monster and delivered Andromeda on the coast of Ethiopia, he effected his purpose by raising himself in the air through the aid of the wings and talaria given to him by Mercury, and not with the help of the winged horse on which most of the painters mount him. Professor Owen informs me that Roland Savery's picture containing the Dodo, in the Berlin collection, bears the date of 1626; and that the colour of the Dodo in the Duke of Northumberland's picture resembles that of the portrait of the bird, of life size, by the same painter, now at Oxford. L'Estrange describes the hue of the back of the living Dodo which he saw exhibited in London "about 1638," as of "dunn or deare colour."

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* I am indebted to Mr Russell for this information.

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* *Nautilus pompilius*

DESCRIPTIONS OF FIVE NEW SPECIES OF HUMMING BIRDS.

BY JOHN GOULD, F.R.S.

Mr. Gould exhibited five new species of Humming Birds; four collected on the eastern slope of the Andes by M. Warzewicz, remarkable for their size and their great beauty, and one lately received by M. Linden of Brussels, from the Sierra Nevada of Santa Martha, at an elevation of 5000 feet They were described and named as follows:—

1. HELIANTHEA IRIS.

Forehead magnificent green, succeeded on the sides by rich orange and in the centre by blue, all with a highly metallic lustre; throat, neck and chest glittering green, with a small gorget of purplish feathers in the centre of the former; posterior part of the body and tail chestnut-red.

Total length, 5½ inches; bill, 1⅛; wing, 3½; tail, 2½.

Hab. Eastern slope of the Andes.

2. HELIANTHEA AURORA.

The whole of the crown rich metallic green; throat and back of the neck also metallic green, but not so lustrous as on the crown; body and tail chestnut-red, as in the preceding species, but not of so deep a hue.

Total length, 5⅛ inches; bill, $1\frac{5}{16}$; wing, 3; tail, 2.

Hab. Eastern slope of the Andes.

3. HELIANGELUS VIOLA.

Throat and upper part of the chest of the most beautiful violet colour; spot on the forehead brilliant verditer-green; neck, back and abdomen green; tail black.

Total length, 5 inches; bill, ¾; wing, 2⅞; tail, 2½.

Hab. Eastern slope of the Andes.

Remark.—Somewhat allied to *Heliangelus Parzudaki.*

4. TROCHILUS (——?) CYANOCOLLIS.

Crown of the head and sides of the neck greenish blue; upper surface bronzy green; under surface snow-white; tail bronzy green, obscurely crossed near the tip with a dusky band, except the two middle feathers.

Total length, 3¾ inches; bill, ⅞; wing, 2⅜; tail, 1½.

Hab. Eastern slope of the Andes.

Remark.—Nearly allied to *Trochilus Franciæ.*

5. **Trochilus** (——?) **floriceps.**

Forehead buffy white, passing into a beautiful deep peach-blossom hue on the crown; throat grey, passing into the rufous of the abdomen; middle tail-feathers bronzy; lateral tail-feathers largely tipped with buff.

Total length, $3\frac{1}{4}$ inches; bill, $\frac{7}{16}$; wing, $1\frac{7}{8}$; tail, $1\frac{4}{16}$.

Hab. Sierra Nevada of Santa Martha, at an elevation of 5000 feet.

LINNÆAN SOCIETY.

February 7, 1854.—Thomas Bell, Esq., President, in the Chair.

Read a "Notice on the Characters and Synonyms of the genus *Senna.*" By M. J. B. Battka, of Prague. Communicated by G. Bentham, Esq., F.L.S.

The following are the characters by which M. Battka distinguishes the genus:—

Senna, *Breyn. Prodr* ii. p 59, *Tourn Inst.* p. 390; *Gærtn. Carp.* ii p. 312. t. 146.

Calyx 5-sepalus. *Petala* 5, inæqualia. *Filamenta* longiora incurva. *Antheræ* 2-porosæ, 10, supremæ 3 steriles, infimæ 3 radiatæ. *Stigma* centrale *Legumen* membranaceum, oblongum v. reniforme, latum, foliaceum, plano-compressum, bivalve, pluriloculare, dissepimentis transversalibus, loculis monospermis, non pulposis, ad sedes seminum torulosis. *Semina* albuminosa, rostellata, ad suturam superam leguminis hilo funiculis strictis longioribus affixa, testâ carnosâ, matura et siccata subcordata rugulosa v scrobiculata, margine hilo et micropyle callosa, appendicula (loco deficientis plumulæ) lirello-cochleariformi ornata; cotyledones foliaceæ, trinerves, radicula recta; plumula nulla.

Under the head of "Petioli eglandulosi, foliola obliqua," M. Battka enumerates four species,—*S. obovata, S. acutifolia, S. angustifolia,* and *S. tomentosa,* of which he gives the following characters and synonymy.—

1. Senna obovata, foliis 3–6-jugis; foliolis obovatis vel retuso-obovatis mucronulatis basi angustioribus, stipulis petiolorum lanceolata linearibus, leguminibus arcuatis supra seminum sedem verticaliter interruptè cristatis.

Senna, *Math. Com.* 571; *Fuchs. Hist* 447 (1542); *Dod. Pempt.* 360; *Trag. Hist. St.* 964; *Cam. Epit.* 538; *Lob. Adv* 406, *Dalech. Lugd.* 218; *Burm. Ind.* tab. 33. fig. 2.

S. florentina, *Bauh Hist.* p. 377 (excl. ram.); *Chabr. Sciag.* 81 et 611.

S. nostras, *Cæs.* pl. 6. c. 31. p. 249.

S. foliis obtusis, *Ger. Hist.* 1297. ic.

S. Espanol, *Solso, Diss.* Mad. 1774, c. ic.

S. Italica, *C. Bauh. Pin.* 397; *Park. Theat.* 225; *Tournef. Inst.* 618; *Ray, Hist.* 1742; *Sloane, Hist. Jam.* 2. p. 47; *Moris. Hist.* ii. p. 201. tab. 24. fig. 2; *Breyn. Prod.* 2. p. 90; *Tabern. Ic.* 903; *Cam. Hort* m. 159; *Miller, Dict.* n. 2.

S. officinalis, *Gærtn.* tab. 146. fig. 4.

S. hermol, *C. B.*

Sené de Tripoli, *Pomet, Hist. d. Drogues, Uebersetz.* 1717, p. 180.

Cassia Senna, *Linn. Herb., Sp. Pl.* i. p. 539. no. 9; *Murr. App. Med.* 2. p. 502; *Willdenow, Sp. Pl* ii. p. 520. no. 24; *Woodv. Mat. Med.* 446. t. 162 (excl. ram. fol), *Lam. Dict.* p. 46, *Ill.* 3. t. 332. fig. 3 *a*, *b*, *d* et *f*; *Swartz, Obs.* 161; *Ait. Hort Kew edit.* 2. v. 3. p. 27; *Nocca, Inst* 2. p. 3; *Persoon, Ench.* i. p 457; *Galliz. Bot. Agr.* 2 p 413; *Jacq. Eclog. Pl. Rar.* 87. tab. 87, *Forsk. in H. Lugd.*; *Delile, Flore d'Egypte*, f. 420, *Nectoux, Voyage d'Egypte*, t. i. p. 19, *Sieber, Herb. Ægyptiac.*

Cassia Senna β. italica, *Linn.*; *Nees, Dusseldf. Pflz.* t. 348 (excl syn); *Wagner, Ph Med Bot* p 149 t. 180.

C. foliis sejugis subovatis, *Linn Syst* p. 393, *Mat. Med* p 110.

C. obovata, *Collad.* p 92. t. 15. f. A ; *Hayne*, xi. tab. 42 (excl gland), *Le Prieur et Perr Fl. de Seneg* , *Wallich, List*, no. 5319; *Th. Vogel, Syn.* p 35; *Nees, Dusseldf. Pflz.* 347.

C. obovata et obtusata, *Bisch. Med. Ph. Bot.* p. 14, *DeCandolle, Prodr.* ii p. 492.

C. obtusa, *Roxb. Fl. Ind.* 2. p 344.

C. obtusata, *Hayne*, xi. tab. 43, *Th. Vogel, Syn. Gen. Cass.* p. 36 (sec. *Bisch*)

Frutex habitat in desertis Ægypt. et Tripol , in Syriâ et Senegaliâ , folia Senna de Tripoli et Aleppo in commercio dicta, inter folia Sennæ Alexandrinæ admixta. Legumina nom folliculorum Sennæ c. leguminibus S. acutifoliæ in commercio venduntur.

2. Senna acutifolia, foliis pinnatis 3–5-jugis sine et cum impari, foliolis ovalibus lanceolato acutis subæqualibus nervo medio piloso, stipulis linearibus subulatis pilosis, leguminibus lato-oblongis et reniformibus

Cassia acutifolia, *Delile, Flore d'Egypte in Explic des Planches*, ii. p. 213 (excl. *Icon.* tab 27. fig. 1), *Rich. Bot. Med.* ii p. 573.

C. orientalis, *Persoon, Syn. Pl.* p. 457 (excl. syn. *Forsk.*).

C. lanceolata, *Colladon*, p. 93. t. 15. fig C (excl. descript), *Hayne, Off. Gewachse*, xi. t. 41 (excl synon.), *Nees, Dusseldf. Pflz.*, *Consp.* 347 (excl. syn.); *DeCandolle, Prodr.* ii. p. 492 (excl. gland.); *Nectoux, Voy d'Egypte*, p. 20. tab. 2.

C. alexandrina foliis acutioribus, *Math. Com.* 571 f. 2; *C Bauhin, Pin.* 397; *Tournef Inst.* 618, *Ray, Hist.* 1742; *Moris. Hist.* ii. p. 201. s. 2. t. 24 fig. 1, *Tabern Krauterb.* iii. p. 220; *Breyn. Prodr.* 2. p. 89; *Miller, Dict* n. 1.

C. Senna β, *Linn Sp. Pl.*, *Mat Med.* 200, *Murray, App. Med.* 2. p. 502; *Willdenow, Sp. Pl.* 2. p 520; *Woodv. Mat. Med.* 446. t 162 (excl. ram. fruct); *Sennaar, Kotschy* (1810), *in Hb. Mus. Brit.* n. 315.

Sené de la Palte, *Pomet, Hist. d. Dr. Uebersetz* (1717) p. 179; *Diction. d. Dr.* 2. p. 545.

Frutex habitat in Ægypto et Sennaar.

Senna alexandrina et officinalis in commercio dicta.

3. Senna angustifolia, caule lævissimo, foliis pinnatis 5–7- subinde 9-jugis; foliolis angustè lanceolatis plerumque glaberrimis, stipulis subulatis, leguminibus lato oblongis rariùs incurvis, seminibus albidis rugulosis.

Cassia angustifolia, *Vahl, Symb.* i. p. 295; *Willden. Sp.* 2. p. 523. *in Herb. Berol.*

C. Senna, *Forskal in Herb. Mus. Brit.* (excl. descr. in *Fl. Ægypt. Arab.* p. 85. n. 58); *a Dom. Wallich missa ex Horto Bot. Calcuttæ, Hb. Schumach.*!

C. lanceolata, *Royle in Herb. Mus. Brit.*; *Illustr. Himal. Mount.* p. 186, 291. t. 37; *Wight, in Mus. Brit. Hb. Penins. Ind. Or.* no. 651; *Ehrenb et Hempr. in Hb. Berol.*!

C. indica, *Schuhm. Plantelare*, t. i. p. 577.
C. elongata, *Lemaire Lisancourt*, *Dict. des Drogues*.
C. acutifolia, *Nees*, *Dusseldf. Pflz.* tab 346 (excl. synon. *Consp.*).
C. Ehrenbergi, *Bisch. Bot. Zeit.* 1841, col 51 (excl. leg. sublineari).
Sené de Mokka (de la Pique), *Pomet* (*Uebers.* 1717), p. 180
Cassia ligustrinoides, *Schr.* (sec *Vogel*).
Frutex habitat in Arabia, in Lohaja, Mocha, Yemen ; et in India orient. (Agra), in Tinevelly et Calcutta colitur
Senna de Mecca et orientalis in commercio dicta.

4 Senna tomentosa, foliis 5–6–7-jugis, foliolis ovato oblongis plerumque parvis utrinque pubescentibus mucronulatis, stipulis hastatis, leguminibus adolescentibus nigris flavo-velutino-pubescentibus, suturâ superiori pilis setaceis ciliatâ, seminibus interdum lævibus setulosè pilosis.
Cassia pubescens, *R. Brown, in Salt. It. App*
C. ovata, *Merat et Lens, Dict.*
C acutifolia β, *Delile in Hb Propr.*
C. obtusata, *Hochstetter et Steudel in Schimp Pl Arab*, no. 780.
C. pubescens et tomentosa, *Ehrenb. et Hempr. in Hb. Berol.*
C. holosericea, *Fresen. in Flora* 1839, p. 51.
C. æthiopica, *Guib in Hist. d Drogues*, 3 ed iii. p. 219
C. Schimperi, *Steudel, Nomencl. Bot.* ed. 2
C. cana, *Wender* (1837) *in Flora* 1841, p. 355.
Frutex habitat in Arabia et Nubia, foliolis inter folia Sennæ Meccensis (Yemen) ab auctore detecta et a clarr. Bové et Schimper in Arabia (Dschedda) et a cl. Darnaud in Valle Dumrich (Nubiæ) collecta.
Sennæ de Mecca et rariùs Alexandrinæ in commercio admixta.

February 21.—Thomas Bell, Esq., President, in the Chair.

Read a "Note on the genus *Ancistrocladus* of Wallich." By G. H K. Thwaites, Esq., Superintendent of the Botanic Garden of Peradenia, Ceylon.

The author refers to the various positions which different authors, relying on the circumstance of the fruit of *Ancistrocladus* being surrounded by the enlarged segments of the calyx, have assigned to that genus, which has been successively placed in *Combretaceæ*, *Malpighiaceæ*, and *Dipterocarpeæ*, from all of which, however, it differs by its seeds being albuminous. An examination of the flowers and fruit in various stages of development has induced him to conclude that it will associate better with *Symploceæ*, with which it agrees in its undivided exstipulate leaves, its character of inflorescence, imbricate calyx and corolla, persistent calyx, stamens adhering to the base of the corolla, inferior ovary, albuminous seeds and cylindrical embryo; but from which it differs in its scandent habit, its calycine segments becoming enlarged, its solitary erect ovule, and the peculiar structure of its albumen. He notices a slight affinity to *Myristiceæ* and *Annonaceæ*, its young ovule calling to mind that of *Myristica*, and the embryo not being very dissimilar; while the scandent habit and uncinate ramuli give it a considerable resemblance to *Artabotrys*. The following generic character has been drawn up from fresh specimens of *Ancistrocarpus Vahlii*, Arn., and from the figure of *Anc. Heyneanus*, Wall., given in the last volume of Dr. Wight's 'Icones Plantarum Indiæ Orientalis':—

Genus SYMPLOCEIS *affine* ANCISTROCLADUS, *Wall.*; Wormia, *Vahl*;
Bigamea, *Kœn.*

CHAR. GEN.—*Flores* hermaphroditi. *Calyx* tubo cum ovario connato; limbo 5-partito, laciniis oblongis, irregularibus, imbricatis, tribus majoribus, omnibus increscentibus, persistentibus. *Corollæ* petala 5, æqualia, concava, basi connexa. *Stamina* 5, imæ corollæ inserta, petalis alterna (in *Anc. Heyneano* stamina 10 in seriebus duabus); filamenta basi incrassata, monadelpha, apice cuspidata, antheræ adnatæ, biloculares, longitudinaliter dehiscentes, loculis basi divergentibus. *Ovarium* inferum, 1-loculare. *Ovulum* unicum, erectum, anatropum. *Stylus* subglobosus, persistens; stigmata 3, erecta, linearia, compressa, truncata, decidua. *Nux* coriacea, calycis laciniis coronata. *Semen* cerebriforme, erectum, testâ plicato-intricatâ albumen carnosum plicis suis involventi. *Embryo* orthotropus, clavatus; cotyledones subfoliacei, divergentes, radicula prope hilum posita.

Frutices *Indici et Zeylanici, soboliferi, scandentes*; ramis *elongatis, teretibus*, ramulis *brevibus, patentibus*; uncis *circinatis, sub nodis ramulorum positis, internodia terminantibus*, foliis *lanceolatis, utrinque angustatis, sessilibus, integerrimis, lævibus, penniveniis, densè reticulatis, in ramis distantibus, ad ramulorum apices aggregatis, vernatione convolutis*, inflorescentiâ *axillari, racemosâ*; racemis *plùs minùs ramosis*, pedunculis *angularibus, paucifloris*, floribus *alternis*; pedicellis *brevissimis, rachi articulatis*; bracteis *minutissimis*.

Ancistrocladus Vahlii, Mr. Thwaites observes, is very abundant in some of the warmer districts of Ceylon, and is a very troublesome weed to the cultivators. The Cinghalese name is *Gonawel* or *Gonapittanwel*.

Read also "Notes on some Ferns in the Wallichian Herbarium." By Thomas Moore, Esq., F.L.S. &c.

These notes are the result of an examination of the Ferns of the Wallichian herbarium, with the view in the first instance of determining the genus *Prionopteris* of Wallich, cited by both Presl and Fée, but evidently without any knowledge on the part of either of those botanists of the plant on which it was founded. *Prionopteris Farquhariana*, Wall. Cat. No. 184, was thus ascertained to be *Matonia pectinata*, R. Br. in Wall. Pl. Asiat. i. p. 16. t. 16, a name adopted by Dr. Wallich in his Catalogue at the bottom of page 23, where he directs it to be substituted for *Prionopteris*. In the course of this examination, Mr. Moore further determined *Sphæropteris Hookeriana*, Wall. Cat. No. 775, in corrig. p. 248, to be the same with *Diacalpe aspidioides*, Blume; a genus distinguished from *Sphæropteris* by its sessile, not stipitate, sori, and which Mr. Moore refers to a section (*Woodsieæ*) of *Polypodieæ*, which connects that group with the *Cyatheæ*. Dr. Wallich compares it with *Davallia stipellata*, Wall. Cat. No. 260, which it resembles in general appearance, but the fructification is altogether different. *Davallia stipellata* was identified with *Acrophorus nodosus*, Presl, and doubtfully with *Monachosorum* *davallioides*, Kunze. This genus the author referred rather to *Aspidieæ* than *Davallieæ*, placing it with *Cystopteris* in a subsection of the former, which forms a connecting link with the latter through the genus *Microlepia*. In the view here proposed it would include most, if not all, of the species which have been referred to *Leucostegia*, as well as a fern described by Sir W. Hooker under the name of *Davallia Jamaicensis*. The species of the genus *Acrophorus* would consequently stand as follows :—

1. *Acr. nodosus*, Presl = Aspidium nodosum, *Blume*; Davallia stipellata, *Wall.*; Davallia nodosa, *Hook.*; Monachosorum davallioides, *Kunze*?

2. *Acr. immersus* = Davallia immersa, *Wall.*; Leucostegia immersa, *Presl.*

3. *Acr. chærophyllus* = Davallia chærophylla, *Wall.*; D. ligulata, *Wall.*; D. pulchra, *Don*, fide not. MS. in Herb. Soc. Linn., Leucostegia chærophylla, L. ligulata, and L. pulchra, *J. Smith.*

4. *Acr. affinis* = Leucostegia affinis, *J. Smith*; Davallia affinis, *Hook.*

5. *Acr. hispidus* = Davallia hispida, *Heward*; D. Novæ-Zelandiæ, *Colenso.*

6. *Acr. membranulosus* = Davallia membranulosa, *Wall.*

7. *Acr. parvulus* = Davallia parvula, *Wall.*, Leucostegia parvula, *J. Smith.*

8. *Acr. Jamaicensis* = Davallia Jamaicensis, *Hook.*

March 21.—Thomas Bell, Esq., President, in the Chair.

Read a paper "On the genus *Myrmica* and other Ants." By John Curtis, Esq., F.L.S. &c.

After referring to the more important published works on the subject of Ants, such as those of Latreille, Nylander and Fœrster; and to the difficulties attending the study of this family on account of the different phases under which each species appears, Mr. Curtis proceeds to enumerate the British species of *Myrmica*, *Stenamma* and *Myrmecina*, and to describe and figure some English *Myrmicæ*, which are either new or imperfectly known. He commences by dividing the British *Formicidæ* as follows :—

A. with a single scale upon the petiole.
  Palpi 6- and 4-jointed.
    Mandibles of female elongated .. 1. *Formica*, Linn.
    Mandibles of female triangular .... 2. *Ponera*, Latr.

B. with two nodules on the petiole.
  Superior wings with the apical cell elongate and open.
    Palpi 6- and 4-jointed .... 3. *Myrmica*, Latr.
    Palpi 4- and 3-jointed .... 4. *Stenamma*, Westw.
  Superior wings with the terminal cell closed, oval and pedicled .... 5. *Myrmecina*, Curt.

He next gives detailed characters of the genus *Myrmica*, under which he enumerates the following species :—

1. *Myrmica rubra* = Formica rubra, *L.*; M. scabrinodis, *Nyl.*, var.
2. *M. lævinodis*, Nyl.
3. *M. vagans* = Formica vagans, *Fabr.*; M. ruginodis, *Nyl.*
4. M. LONGISCAPUS, *Curt.*, a new species which resembles *M. lævinodis*, but the males are much smaller, the antennæ are much longer, and instead of the scape being only as long as the two basal joints of the flagellum (as in *M. lævinodis* and *M. rubra*), it is equal in length to the eight following joints. Other differences are also pointed out and figured. The species was first found in Perthshire, and Mr. Curtis has since received specimens collected in the neighbourhood of Manchester by Mr. R. Wood.
5. M. PERELEGANS, *Curt.*, another new species, of which the male, female, and neuter are figured, and of which a detailed description is also given. It was found by Mr. Curtis near Bournemouth in Hampshire, in July 1850, and seems to approach the *Formica subterranea* of Latreille, but the neuter has the upper surface of the head black, and the first nodule has not a long petiole, as described and represented in all Latreille's figures, the male has not very pale yellow legs; nor the female a brown, very shining thorax, with a brown petiole. It may be related to *F. acervorum*, Fabr., but that species is described as having the back of the thorax black.
6. *M. acervorum* = F. acervorum, *Fabr.*, M. lacteipennis, *Zett.*
7. M. DENTICORNIS, *Curt.*, found by Mr. Curtis in Scotland in July 1825, and no doubt allied to *M. lobicornis*, Nyl., but having the tooth in the knee at the base of the scape in the neuter much less developed, and other differences in the rugosity and striation of the head, thorax and nodules. Of this species the male and neuter are also figured.
8. *M. cæspitum* = F. cæspitum, *L.*; M. fuscula, *Nyl.*; M. impura, *Færst* var., and M. modesta, *Færst.*?
9. *M. tuberum* = F. tuberum, *Fabr.*, F. tuberosa, *Latr.*
10. *M. simillima*, Nyl. MSS.
11. *M. graminicola* = F. graminicola, *Latr.*
12. *M. unifasciata* = F. unifasciata, *Latr.*
13. *M. domestica*, Shuck.

Under the genus *Stenamma*, Westw., Mr. Curtis enumerates two species:—

14. *St. Westwoodii*, Steph., of the male of which he gives a description, together with a figure of the wing.
15. ST. ALBIPENNIS, *Curt.*, a new species discovered by himself near Dover in July 1852, which is described in detail.

The genus *Myrmecina*, Curt., is limited to a single species:—

16. *M. Latreillii*, Curt., of which the male and female are described at length, and the latter figured, with details of the several parts.

In conclusion Mr. Curtis expunges from the list of British insects *Formica pubescens*, Latr., and *F. emarginata*, Oliv., admitted on doubtful authority; and *F. cognata*, Steph., which is not to be found in Mr. Stephens's cabinet, now in the British Museum.

Read also some "Notes on the Habits of the common Garden Ant, *Formica nigra*, L." By George Daniell, Esq. Communicated by the Secretary.

This ant infests in large numbers Mr. Daniell's garden at Chobham. Stragglers appear in the greenhouse about the middle of February, and they had this season become numerous by the 5th of March: as the weather becomes warmer they spread themselves all over the garden. In fine weather they bring forth their white pupæ and spread them in little heaps in the sun by the side of a turf, stone, or garden-pot; not unfrequently forming their dwellings in the bottom of the flower-pots among the roots of the plants. As the summer advances they even extend their colonies into the meadows, and form small round hillocks among the grass. They are very pugnacious and defiant, and do not hesitate to attack flies, gnats, and even bees. A number of them were on one occasion seen clustering round a honey-bee, and on being struck off with the finger-nail, they returned to the charge in the most fearless and daring manner, and eventually dragged off the bee. Last year, when the vines were much infested with the *scale*, or *Coccus Vitis*, L., thousands of ants clustered on the trunks of the vines, apparently feeding on the black excrement voided by this pest. In the same manner they feed around the green *Aphides*, which more particularly infest the *Calceolarias*. Not only the cast skins of the *Aphides*, but the insects themselves, are carried off by the ants. The *Aphides* appear to be comparatively safe while buried beneath the long hairs of the *Calceolarias*, and other similar plants; but the ants evidently make great efforts to dislodge them, while the *Aphides* parry the attack with their legs. On shaking the plants and dislodging some of the *Aphides*, the latter were immediately set upon by the ants below, which first broke their legs and stripped them of their wings, and then carried them off. The winged female ants are seen in June, not however using their wings much in flight, but quivering and shaking them as they walk along, each accompanied by several workers.

ROYAL SOCIETY.

November 16, 1854.—Col. Sabine, R.A., in the Chair.

"Observations on the Respiratory Movements of Insects." By the late William Frederick Barlow, F.R.C.S. Arranged and communicated by James Paget, F.R.S.

This essay contains the greater part of a series of observations made between 1845 and 1850. The following are some of the conclusions which they plainly indicate:—

(1.) The respiratory movements of Dragon-flies (Libellulæ), and, probably, of other insects also, are naturally subject to considerable and frequent variations in force and rate, the causes of many of these variations being as yet unknown.

(2.) The respirations of these insects are always quickened by exercise, emotion, rise of temperature, galvanism, and mechanical irritation; and the last three agents quicken them in the decapitated, as well as in the perfect, insect

(3.) The respiratory movements of each segment of the trunk are, in some measure, independent of those of the rest, although in the perfect insect they concur in all the segments. They continue to be performed, though feebly and slowly, in separated segments, provided their nervous cords and ganglia are entire: and they may be abolished in single and successive segments by the local action of chloroform.

(4.) The removal of the head, including the supra- and sub-œsophageal ganglia, does not, like the removal of the medulla oblongata of the vertebrate animal, put a stop to the respiratory movements of the insect; but it diminishes their frequency and force, and deprives them of all influence of the will and of mental emotions.

(5.) The shock inflicted by the sudden destruction of the head, or of the terminal part of the abdomen, generally stops all the respiratory movements of the insect for a time, and much enfeebles them during the remainder of its life.

(6.) The general tendency of the observations is to corroborate the opinion of the self-sufficiency of the several ganglia for the movements of their appropriate segments, and, thus far, to maintain the belief in their essential independence. At the same time, the observations on the diffused influence of shocks accord with those of the coordinate similar movements of all the segments, in proving their close mutual relations and mutual influence.

"On the Structure of some Limestone Nodules enclosed in Seams of Bituminous Coal, with a Description of some Trigonocarpons contained in them." By J. D. Hooker, M.D., F.R.S., and E. Binney, Esq.

The authors first describe the occurrence of the limestone nodules, which form a continuous bed in the centre of a thin seam of bituminous coal in the lower part of the Lancashire coal-field. The nodules were of various sizes, some weighing many pounds, and caused the coal to bulge out both above and below them, and they were found to be entirely composed of vegetable tissues converted into carbonate of lime and magnesia. Their formation is supposed by the authors to be due to infiltration of water through the superincumbent shales, which were full of fossil shells supposed to be of marine origin, and the aggregation of the mineral matter round centres of vegetable remains. The chemical constituents of the nodules were found to be carbonates of lime and magnesia, sesquioxide and sulphate of iron, with a little carbonaceous matter.

The probability of these nodules representing an average sample of the vegetable constituents of the surrounding coal is then discussed, and attention is drawn to the very great interest and importance that would attach to them were such a view substantiated, as showing the exact nature of the association of plants which is capable of conversion into bituminous coal.

All the plants contained in the nodules were common in other parts of the coal formation, viz. *Calamodendron*, *Halonia*, *Sigillaria*, *Lepidodendron*, *Stigmaria*, *Trigonocarpon*, *Anabothra*, and others; of these the first-named genus occurred in the greatest abundance and as large fragments of fossil wood. Very many of the specimens were sliced, and being reduced to very thin transparent sections, were examined with the view of determining the botanical character of their contents, and the intimate structure of the masses of more or less homogeneous aspect to which they were reduced by decomposition, previous to or during the operation of calcification. The results were very satisfactory, and seemed to indicate that all traces of vegetable structure may be completely obliterated in the substance of highly bituminized coal, which may nevertheless also contain fragments of wood with their tissues preserved.

An account is then given of the examination of the details of structure of *Trigonocarpon*, and this, as well as the comparison of *Trigonocarpon* with the modern genus *Salisburia*, is illustrated by drawings and analyses.

The authors are still engaged with the study of these nodules, with the view of showing the relationship between *Calamodendron*, *Calamites*, *Sigillaria* and *Anabothra*, and the details are preparing for publication.

BOTANICAL SOCIETY OF EDINBURGH.

December 14, 1854.—Professor Balfour, President, in the Chair.

The Secretary was directed to enter upon the minutes, an expression of the Society's sense of the great loss which science had sustained in the sudden and unexpected death of Professor Edward Forbes, and of their sympathy with his family in the bereavement.

Office-bearers for the ensuing year were elected, as follows:—

President.—Professor Balfour.

Vice-Presidents.—Dr. Seller, Henry Paul, Esq.; James Cunningham, Esq.; Charles Jenner, Esq.

Council.—James M'Nab, Esq., Dr. Priestley; Dr. W. H. Lowe; Professor Blackie; William Ivory, Esq.; G. R. Tate, Esq., Professor Fleming; Professor Simpson; John Lowe, Esq.; Robert Daw, Esq.

Honorary Secretary Dr. Greville.—*Foreign Secretary:* Dr. Douglas Maclagan.—*Auditor:* William Brand, Esq.—*Treasurer:* William W. Evans, Esq —*Curator of Museum:* George S. Blackie, Esq.—*Artist:* Neil Stewart, Esq.—*Assistant-Secretary and Curator:* Mr. G. Lawson.

Dr. Balfour read an extract from a letter he had received from Dr. W. A. White, Assistant Surgeon 47th Regiment, dated "Camp before Sebastopol, Nov. 17, 1854," accompanying seeds of a superior melon he had gathered in the orchards on the banks of the Katscha. "All who visited those orchards were surprised at the extraordinary abundance and variety of the fruit-trees. Very many different varieties of the apple and pear, peaches, apricots, nectarines, quinces, the plum, the cherry, the walnut, the almond, the fig, were growing in the greatest profusion within the space of an acre, whilst the surrounding vineyards were laden with the finest grapes. Vegetables too were in great abundance, the enormous size of which excited our surprise, considering the little apparent amount of labour expended on their cultivation. The garden implements were rude and simple, a rich soil and a warm southern sun rendering any artificial operations unnecessary. The country after passing the Belbec is thickly wooded with dwarf oak for the distance of about four miles, when a rapid descent takes place into the Valley of Inkermann, at the south-western extremity of which Sebastopol is situated, which is surrounded with bare rocky hills nearly destitute of vegetation."

Dr. Balfour exhibited specimens of *Chætophora endiviæfolia*, sent by Miss Susanna Beever, from Stanley Water on the Fell near Coniston Old Man.

The following papers were read:—

1. "Sketch of the Life of the late Professor Edward Forbes," by Professor Balfour. This paper appeared in the 'Annals of Natural History' for last month.

2. "On *Hypericum anglicum*," by Charles C. Babington, M.A., F.R.S. See p. 92.

3. "On the Structure of the Anthers of *Erica*," by John Lowe, Esq.

The author remarked, "I have to bring before the Society's notice this evening, a short sketch of two peculiar features occurring in the anthers of the genus *Erica*. The anthers of this genus are usually described in botanical works as consisting of two loculi, which open and discharge their pollen by means of lateral pores. So far this is true, for if we examine a fully expanded flower, the anthers will be seen to be free, and to have a pore, or rather slit on each side; but if a young, unexpanded flower be examined, the anthers instead of being free will be found to be connected together into the form of a circle, and no pores will now be seen. Their future disconnection appears to be caused by the increase of the pollen, in the same manner that valves are separated in valvular dehiscence. The first who noticed the peculiarity above mentioned was, I believe, that very accurate observer Mr. Robert Brown, who thus describes it in the 'Hortus Kewensis,' so long ago as 1811: 'Antheræ ante anthesin per duo foramina lateralia connexæ.' The only other work in which I find it noticed is M'Gillivray's edition of 'Withering's British Botany'; but there is a want of that accuracy observable in the preceding work. [See Smith, Eng. Fl. ii. 225.] The other peculiarity referred to is the separation which occurs between the loculi of the same anther. In all the species examined this prevails to a greater or less extent. In some the division extends almost, in others quite, to the base of the anther, and in two species, *E. Banksiana* and *E. Sebana lutea*, there is so complete a separation, that the loculi of adjoining anthers have a greater connection than those of the same anther. In these two instances, the filaments are expanded into the form of a tube, and there appears, in all the species examined, to be a nearly constant ratio between the amount of the filamentary expansion and the separation of the loculi. One apparent exception is found in *E. vernix coccinea*, but here the filaments, though much expanded at the base, are attenuated superiorly. From these facts it would almost seem that the rigidity of the filaments has some effect in causing the separation of the loculi; for where the filaments are most slender and delicate, the least amount of separation occurs, and *vice versâ.*

The mode in which this result is produced, is apparently by the strong filaments, as they increase in size, drawing the loculi apart, whilst the slender ones yield and bend inwards, allowing the loculi to retain their position. In proof of this we find, that when the filaments are strong, or united into a tube, the circle of united anthers is large, and when the filaments are slender, the antherine circle is small, and the filaments, though brought together at their apex, are wider apart, and even bulging below. The number examined is twenty-three, the names of which are given in the following list. I have not been able to observe whether any peculiarities exist in the anthers of the allied genera, as they are not now in flower.

Erica Caffra.
—— rupestris.
—— Eassoniana purpurea
—— rubens.
—— Lambertia rosea.
—— linnæoides.
—— Aitonia Turnbullii.
—— —— turgidula.
—— ampullacea.
—— arbuscula.
—— cerinthoides.
—— taxifolia.

Erica magnifica.
—— Banksiana.
—— verticillata.
—— hyemalis.
—— vernix coccinea.
—— Sebana lutea.
—— melanthera.
—— Princeps.
—— magnifica.
—— vestita coccinea.
—— ventricosa superba.

4. "Summary of the Flora of the Lake district of England," by Mr. James B. Davies.

Mr. Davies read a full list of the rarer plants of the district, with their habitats, which he remarked would be found in the Appendix to Black's admirable 'Guide to the Lakes.'

MISCELLANEOUS.

Observations on the Nests of Humming Birds.

By John Gould, F.R.S. &c.

Mr. Gould exhibited a collection of nests of Humming Birds, exemplifying the habitual characteristic structures of several genera. The first group to which his remarks were directed were the Hermit birds (*Phaëthornis*), which invariably build at the extremity of leaves, perhaps from the protection which that situation affords against the attacks of monkeys and other predatory animals. *Oreotrochilus* builds a beautiful nest, attached to the sides of rocks. *Heliomaster mesoleucus* makes a nest in a beautiful species of moss, depending from the trees. Most of the nests are cup-shaped, some being placed in forks, some on branches, some on leaves, some in ferns; they are shallow and delicately formed, ornamented in the most varied manner with feathers, or with festoons of moss and lichen, especially in the genus *Hylocharis*. The attachment of the lichen and other ornaments is effected by means of fine cobwebs.

The differences in the eggs of Humming Birds are not very observable; they are invariably two in number, white and oblong, with one supposed exception,—namely, that of a species inhabiting the Upper Amazon, which, according to Mr. Edwards, lays a spotted egg. But the differences of structure in the nests sufficiently corroborate the generic divisions into which these birds have been separated by modern ornithologists.

Most of the nests exhibited were from the collection of Mr. Reeves of Rio, who presented them to Mr. Gould in the most liberal manner, with a view to assisting him in the completion of his monograph of this family.—*Proc. Zool. Soc.* July 26, 1853.

On a Marsupial Frog (Notodelphys ovifera) *from Venezuela.*
By Dr. D. F. Weinland.

Under the name of *Notodelphys ovifera*, Dr. Weinland has described a singular frog lately received by the Berlin Museum, the female of which possesses large dorsal sacs for the reception of the ova. These sacs open by a fissure in the skin of the back near the anus; they were full of eggs in the specimen examined by the author, but had no communication with the cavity of the body. The eggs were only fifteen in number, of large size, and contained embryos in a forward state of development, exhibiting a broad head, very similar in form to that of the parent, and already furnished with distinct eyes. The body of the embryo terminated in a short tail, at the base of which the hinder feet were visible. The anterior feet were also developed. The embryo had no sucking disc attached to the throat. The external branchiæ consisted of a pair of large membranous bill-shaped organs attached to the branchial arches by long vascular filaments, two to each bill

In its general structure the animal approaches the Tree-frogs (*Hyla*), and it appears not improbable that the *Hyla marsupiata* of Dumeril and Bibron, which also possesses a dorsal sac, may belong to the same genus.—*Müller's Archiv*, 1854, p. 449.

Descriptions of Two New Species of Ptilonopus.
By George Robert Gray, F.L.S. & F.Z.S.

Ptilonopus chrysogaster, G. R. Gray.

Crown purplish white, margined posteriorly with yellow; sides of the head, neck and breast greyish white, with the base of the feathers of the latter yellow; throat and cheeks pale yellow; abdomen and under tail-coverts bright yellow; sides of the former greyish white, tinged with yellow; back bronzy green; greater wing-coverts, tertials and secondaries bluish green, narrowly margined with yellow; quills dull black, with the outer web tinged with green; tail bronzy green, with a very broad apical margin of white, each feather margined with yellow.—Total length, 8¾ inches.

Hab. ——? Probably from Otaheite.

This species is closely allied to the *Pt. purpuratus* (*Columba purpurata*, Gmel., *C. oopa*, Wagl., *Pt. furcatus*, Peale), but it is easily distinguished by the yellow on the abdomen, &c.

PTILONOPUS PURPUREOCINCTUS.

Crown and base of lower mandible deep rosy purple, surrounded posteriorly with yellow; throat white; sides and behind the neck greenish grey; feathers of the upper part of the breast deep greyish green, with the end of each bifurcation white; lower part of the breast green, with a broad mark of deep purple; middle of the abdomen yellowish green, with the sides orange; vent pale yellow, with the sides green; under tail-coverts orange; back and lesser wing-coverts bronzy green; greater wing-coverts, secondaries and tertials bluish green, margined with yellow; quills green, narrowly margined with yellow, tail green tinged with yellow, with the apical portion broadly margined with white, tail-feathers tinged on the outer web with green, and all margined with yellow.—Total length, 9 inches.

It is unknown from whence this fine species was brought.—*Proc. Zool. Soc.* March 22, 1853.

METEOROLOGICAL OBSERVATIONS FOR DEC. 1854.

Chiswick.—December 1. Clear and fine 2. Overcast: very large halo round the moon. 3. Cloudy: clear. 4. Clear and fine. 5. Fine cloudy. clear at night: rain 6, 7. Fine cloudy. 8. Densely overcast. 9. Cloudy. 10. Clear and cold. 11. Sharp frost: fine 12 Very fine 13. Hazy: overcast rain 14. Densely clouded. 15. Dusky flying clouds. overcast rain. 16. Cloudy fine. 17. Clear: fine. rain 18. Rain: heavy clouds clear and cold. rain. 19. Very fine. rain. 20. Stormy and wet. 21. Fine: rain: overcast. 22. Cloudy and boisterous: rain at night. 23. Fine cloudy overcast rain. 24. Fine rain 25. Densely clouded. rain. clear and fine. 26. Clear and fine. 27. Fine. 28. Clear and frosty: very fine frosty. 29. Overcast. 30. Cloudy. fine. 31. Overcast. cloudy. boisterous.

Mean temperature of the month .... 39°·35
Mean temperature of Dec 1853 .... 32 ·49
Mean temperature of Dec. for the last twenty-eight years ... 39 ·64
Average amount of rain in Dec. .... 1·50 inch.

Boston.—Dec 1, 2 Fine. 3. Cloudy. rain P.M. 4. Fine. 5. Cloudy. 6. Fine: rain A.M. and P.M. 7. Fine. 8. Cloudy. 9. Fine rain and snow P.M. 10, 11. Fine. 12. Fine: rain P.M. 13. Cloudy. 14. Cloudy: rain A.M. 15. Fine. 16. Fine rain A.M. 17. Fine. 18. Rain A.M. and snow P.M. 19. Fine. rain P.M. 20 Rain A.M. 21. Cloudy. rain A.M. 22. Cloudy. 23, 24. Fine. 25. Cloudy: rain P.M. 26. Cloudy. 27. Fine: rain A.M. and P.M. 28. Fine. 29—31. Cloudy.

Sandwick Manse, Orkney.—Dec. 1. Snow-showers A.M.: hail-showers P.M. 2. Snow-showers A.M.. cloudy P.M. 3. Rain A.M.: showers P.M. 4. Showers A.M. and P.M. 5. Showers A.M.: cloudy P.M. 6. Showers A.M and P.M. 7. Cloudy A.M.: sleet-showers P.M. 8. Showers A.M.. sleet-showers P.M. 9. Showers A.M. and P.M. 10. Bright A.M.: snow P.M. 11. Cloudy A.M.: showers P.M. 12. Sleet-showers A.M.: showers P.M. 13. Cloudy A.M.. showers, thunder and lightning P.M. 14. Sleet-showers A.M.. showers P.M. 15. Sleet-showers A.M. and P.M. 16. Hail-showers A.M.: sleet-showers P.M. 17. Sleet-showers A.M.: hail-showers, frost P.M. 18. Hail-showers, frost A.M. and P.M. 19. Cloudy, frost A.M.: rain P.M. 20. Sleet-showers A.M.: clear P.M. 21. Drizzle A.M: showers P.M. 22. Damp A.M.: sleet-showers P.M. 23. Hail-showers A.M.: sleet-showers P.M. 24. Showers A.M.: sleet-showers P.M. 25. Showers A.M.: hail-showers P.M. 26. Snow A.M.. hail-showers P.M. 27. Snow A.M.: snow, clear P.M. 28. Snow, cloudy A.M.: rain P.M. 29. Drizzle A.M. and P.M. 30. Sleet-showers A.M.: hail-showers P.M. 31. Showers A.M.: rain P.M.

Mean temperature of Dec. for twenty-seven previous years . 41°·10
Mean temperature of this month .... 39 ·13
Mean temperature of Dec. 1853 .... 38 ·97
Average quantity of rain in Dec. for fourteen previous years 3·95 inches.

Meteorological Observations made by Mr. Thompson *at the Garden of the Horticultural Society at* CHISWICK, *near London;* *by* Mr. Veall, *at* BOSTON; *and by the* Rev. C. Clouston, *at Sandwick Manse,* ORKNEY.

Days of Month.	Barometer					Thermometer					Wind			Rain.		
	Chiswick.		Boston, 8½ a.m.	Orkney, Sandwick.		Chiswick.		Boston 8½ a.m.	Orkney, Sandwick		Chiswick 1 p.m.	Boston	Orkney, Sandwick.	Chiswick.	Boston.	Orkney, Sandwick.
1854. Dec.	Max.	Min.		9¼ a.m.	8¼ p.m.	Max	Min		9¼ a.m.	8¼ p.m.						
1.	29·730	29·422	29·08	29·12	29·30	51	30	37	32	32	w.	w.	nw.	...	·12	·19
2.	29·951	29·768	29·40	29·42	29·64	46	34	37	32	31½	nw	nw.	se	...	...	·19
3.	29·937	29·762	29·46	29·18	28·92	50	41	42	46½	44½	nw.	w	wsw	..	...	1·10
○ 4.	30·025	29·894	29·55	29·41	29·11	50	38	42	42½	43	w.	wnw	s.	.	·02	·09
5.	29·509	29·318	29·15	28·57	28·57	51	32	47·5	44	42	sw.	sw.	ssw.	·04	...	·26
6.	29·656	29·424	28·98	29·12	29·76	45	31	40	41½	38	w	w.	nw.	...	...	·15
7.	30·137	30·035	29·71	30·00	29·42	42	23	34	37	36	n	nnw.	s.	...	·13	·05
8.	29·892	29·483	29·44	29·13	29·02	50	38	42	45½	40	sw	wsw.	w	·01	...	·45
9.	29·634	29·442	29·07	29·23	29·69	45	30	36	39	37	w	nw.	nw.	·04	...	·28
10.	30·057	29·833	29·56	29·91	29·70	39	19	33	38	35	n	nw.	sse.	...	·10	·03
11.	30·045	29·856	29·68	29·24	29·15	44	24	27	47½	40	sw	sw.	wsw	.	...	·17
☾ 12.	30·057	30·002	29·32	29·42	29·22	45	30	34	40½	43	sw	w.	sw.	·03	...	·22
13.	30·190	29·967	29·80	29·22	29·24	52	42	37	41	40	sw.	sw.	w.	·02	·18	·16
14.	30·017	29·945	29·42	29·40	29·50	55	49	51	42½	41	sw.	w.	w	·01	·05	·40
15.	30·112	29·808	29·46	29·45	29·50	54	42	51	38	37	w.	w.	nw	·09	...	·16
16.	29·869	29·657	29·32	29·50	29·53	47	26	39	37½	39	w.	w	wnw	...	·58	·12
17.	29·939	29·752	29·55	29·35	29·27	45	33	33	39	33	nw.	w.	wnw.	·10	...	·41
18.	29·464	29·002	28·73	29·28	29·61	39	29	38·5	35	35	n.	n	nw	·14	·09	·18
● 19.	29·730	29·701	29·40	29·45	28·94	44	33	29	35	38½	w	nnw.	se.	·36	·04	...
20.	29·955	29·406	29·14	29·46	29·84	44	24	36	39½	38	n.	n.	nw.	·08	·16	·62
21.	30·125	29·953	29·72	29·51	29·48	51	39	36	47	43	sw.	w.	sw.	·12	·04	·12
22.	29·882	29·828	29·35	29·23	29·37	54	28	53	41	37	sw	w.	nw.	·06	·07	·33
23.	29·895	29·778	29·48	29·56	29·50	47	26	37	38	38	sw.	w.	wnw.	·05	...	·18
24.	29·879	29·768	29·44	29·32	29·19	52	40	34	41½	41½	sw.	w.	sw.	·06	...	·34
25.	29·778	29·528	29·10	28·66	28·94	54	33	51	36	36	sw	wnw.	nw	·04	...	·18
☽ 26.	29·818	29·722	29·36	29·17	29·29	46	32	37	33½	35	w.	w.	wnw.	..	·08	·13
27.	29·948	29·811	29·44	29·62	30·02	41	25	34	25	36	nw	wnw	nw.	·01	·02	·20
28.	30·431	30·313	30·02	30·25	29·94	40	20	30	32	38	nw	nw.	s.	...	·03	·20
29.	30·443	30·396	30·07	29·77	29·86	41	34	33	48½	48	sw	wnw	sw	·01	...	·25
30.	30·444	30·354	29·97	29·60	29·76	47	32	44	41	42½	sw.	w	nw.	...	...	·24
31.	30·328	30·101	29·87	29·60	29·21	47	35	44	46	45	nw.	w	nw.	...	...	·35
Mean	29·963	29·775	29·45	29·392	·02	47·03	31·67	39·0	39·45	38·81				1·27	1·71	7·75

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SECOND SERIES.]

No. 87. MARCH 1855.

XV.—*A Monograph of the Indian species of* Phylloscopus *and its immediate affines*. By Edward Blyth*.

There is no group of birds more difficult to the student of Indian ornithology than the very extensive series of small *Bec-fins*, or "Warblers," known to the French as *Pouillots*, and in parts of England by the name of *Pettychaps*. It is exemplified in Europe by four well-known species†; and as an *avis rarissima* in Europe, the common Indian *Motacilla proregulus*, Pallas (*Regulus modestus*, Gould), which strictly appertains to the series under review, has been obtained in Dalmatia and in Britain;

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* From the Journal of the Asiatic Society of Bengal, No. 5, 1854.

† 1. *Phylloscopus sibilatrix*; Motacilla sibilatrix, *L.*; Sylvia sylvicola, *Latham*. Type of *Sibilatrix*, Kaup.

2. *Ph. Bonelli*; Sylvia Bonelli, *Vieillot*; S. Nattereri, *Temminck*.

3. *Ph. trochilus*; Motacilla trochilus, *L.*, Sylvia fitis, *Bechstein*, also, according to M. Degland, S. icterina, *Temminck* (nec *Vieillot*); S. flaviventris, *Vieillot*, S. angusticauda, *Gerbe*; and S. tamaricis, *Crespigny*.

4. *Ph. rufus*; Curruca rufa, *Brisson*; Sylvia collybita, *Vieillot*, S. loquax, *Herbert*; and by the older British ornithologists erroneously assigned to Motacilla hippolais, *L.*

In addition to these four, in N. Africa, Dr. Rüppell describes—

Ph. umbrovirens, Sylvia umbrovirens, *Ruppell* (described but not figured in his Neuen Wirbelthieren, Vogel, p. 112). From Abyssinia.

Ph. brevicaudatus; Sylvia brevicaudata, *Ruppell*, Atlas, t. 35. From Kordofan.

Another that will probably have to be added to the European fauna is—

Ph. brevirostris; Sylvia brevirostris, *Strickland*, P. Z. S. 1836, p. 98. Procured at Smyrna. Differs from *Ph. rufus* in its greater size, and from *Ph. trochilus* "in the shortness of the beak and the dark colour of the legs."

Lastly, two species are briefly described in Dr. Horsfield's Catalogue of while three of the European species have been stated to occur in India, but at a time when the various Indian Pouillots were undescribed and the multiplicity of distinct species of them was unsuspected. As neither of them, however, would appear to have been met with in the country since the numerous Indian species have been recognized, we are led to infer that certain other species were mistaken for them; and it is highly probable that the *Sylvia sibilatrix* of Dr. Royle's list * refers to our *Ph. nitidus*, and Mr. Gould's *S. trochilus* of W. India † to our *Ph. viridanus*; and perhaps M. Temminck's *S. trochilus* of Japan may likewise prove to refer to some nearly affined species, which he failed to distinguish from the *trochilus* of Europe ‡.

The Indian species have been described under various generic names; and even now it would not appear that systematists are agreed whether to range the accepted typical form, that of *Motacilla trochilus*, L., under *Phyllopneuste* of Meyer (1822), which included also the distinct form of *Mot. hippolais*, L., regarded by Mr. G. R. Gray (in 1841) as typical of *Phyllopneuste*,—or in *Phylloscopus*, Boie (1826), of which *M. trochilus* is cited as typical. In M. Degland's 'Ornithologie Européenne' (1849), *M. hippolais*, L., with three European congeners is referred to *Hippolais*, Brehm (1828), the typical species being termed *H. polyglotta* (Vieillot); and *M. trochilus* and its congeners are as-

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Javanese Birds, Trans Linn. Soc. xiii. 156; neither of which can we identify with Indian species: viz.—

Ph. javanicus; Sylvia javanica, *Horsfield*: seemingly affined to our *Ph magnirostris*. And

Ph. montanus; Sylvia montana, *Horsfield*: apparently affined to our *Ph. tristis*. Of *Ph montanus* (Horsf), the late lamented Hugh E Strickland informed us, that "the wing is 2 in. long, graduated, with the fifth quill longest."

Mr. Strickland adds, from Java,—

Ph. trivirgatus; Sylvia trivirgata, *Temminck*: a species referable to Mr. Hodgson's group *Abrornis*; and it is probable that others of this minor group, from the Archipelago, remain to be described.

* Ill. Him. Bot. Introd p lxxvii In this list are enumerated "*Sylvia sibilatrix*, *S. rufa* (plains), *S. trochilus*, and several species undetermined." It is not probable that either of the names specified is correctly applied; nor certain others in the same list, as especially *Gallus Sonneratii*!

† Proc. Zool. Soc. 1850, p. 90.

‡ Some Japanese birds which we saw with Mr Gould, sent by M. Temminck, and identified by him with European species, certainly presented differences more or less marked. We especially remember the Japanese Robin, Jay, and Bullfinch. The last is probably *Pyrrhula griseiventris*, Lafresnaye, Rev. Zool de la Soc. Cuv. 1841, p. 241.—Since this note was penned, we have seen Mr Gould's figure of the Japanese Bullfinch, in his 'Birds of Asia,' where it is designated *P. orientalis*, Temminck and Schlegel. The Jay, too, is cited by the Prince of Canino as *Garrulus japonicus*.

signed to *Phyllopneuste*. An older name than *Hippolais*, Brehm, occurs, however, in *Ficedula*, Koch (1816), which is adopted by Dr. Rüppell for the Pouillots[*], and by Dr. Schlegel for both groups[†]; but it is faulty as implying these birds to be fig-eaters (or *Beccaficos*), whereas all of the series are exclusively insectivorous, and in no way to be confounded with the highly frugivorous Fauvettes[‡].

In former papers we followed Mr. Gray's arrangement, but with this error, that certain Indian species were assigned to *Phyllopneuste* apud Gray (v. *Hippolais*, Brehm); whereas upon referring to the characters of this genus, as specified by M. Degland, we find that we had misapprehended it, and incline now to suspect that with it should be united the divisions *Culicipeta*, nobis, and *Abrornis*, Hodgson.

In a series of twenty-two species actually before us, excluding *Regulus*, we observe that one only, the European *Phylloscopus sibilatrix* (type of *Sibilatrix*, Kaup), is remarkable for the comparative great length of its wings; whereof the first primary is minute and the second is nearly as long as the third. In all the rest, the small first primary is considerably less diminutive, and the second is much shorter than the third. the proportions varying, however, to some extent, and the wing being more or less rounded in different species, affording a good differential character in several instances. In general, the wings are shorter and more rounded than in the European *Ph. trochilus*; but looking to the *ensemble* of characters, it seems doubtful whether more than three divisions can be retained in the whole series under review. These are: *Phylloscopus*, certain species of which (constituting the *Reguloides*, nobis[§]) offer a close approximation to *Regulus*, and serve to indicate the true systematic position of that genus,—*Regulus* (which M. Degland and others have arranged near *Parus*),—and *Culicipeta* (including *Abrornis*), which should perhaps be merged in *Phyllopneuste* (v. *Hippolais*). Under these three groups only, we now comprise the following Indian species.

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[*] Systematische Uebersicht der Vogel Nord-ost Afrika's (1845), p. 57.

[†] Revue critique des Oiseaux d'Europe (1844), pp 25, 26.

[‡] The four European species described by M. Degland under *Hippolais* are as follows: —

1. *H. polyglotta*; Motacilla hippolais, *L.*, Sylvia polyglotta, *Vieillot*; H. salicaria, *Bonap.*
2. *H. icterina*; Sylvia icterina, *Vieillot* (nec *Temminck*); S. hippolais apud *Temminck*, Manuel, 2nd edit (1820).
3. *H. olivetorum*; Sylvia olivetorum, *Strickland*
4. *H. elaica*; Salicaria elaica, *Landermayer*; Ficedula ambigua, *Schlegel*

[§] J. A. S. xvi. 442.

I. Genus PHYLLOSCOPUS, Boie, *apud* G. R. Gray.

Type *Motacilla trochilus*, L.*

1. PHYLLOSCOPUS RAMA.

Sylvia rama, Sykes, P. Z S. 1832, p 89.

There appear to be two races of this bird, differing a little in shade of colour, but in no other particular that we can discern The bill is rather thicker and the form less slender than in most others of the genus; and together with the colouring, approximate it to *Calamoherpe*, Boie, for a species of which it might be mistaken at first sight†; but the form of the wings and tail, and general character, sufficiently indicate its true position to be as here arranged.

Length 5 in. by $7\frac{1}{2}$ in. in alar expanse wing $2\frac{3}{8}$ to $2\frac{1}{2}$ in.; 1st primary $\frac{9}{16}$ in., the second $\frac{5}{8}$ in. shorter than the third, which about equals the 4th and 5th · tail $2\frac{1}{8}$ in.; its outermost feather $\frac{1}{8}$ in. shorter: bill to gape $\frac{5}{8}$ in. tarse $\frac{3}{4}$ in. Irides dark. Bill dusky above, light carneous below: legs light brown, tinged with plumbeous on the joints. Plumage, above uniform light grayish-brown, below pale or albescent, passing to white on the chin, middle of belly and vent: lores, continued as a slight streak passing over the eye, and the orbital feathers, pale.

This bird is very common in Lower Bengal during the cold season, upon sandy soil above the tideway of the rivers, haunting baubul topes and scattered trees near villages, as well as hedges and bush-jungle. Those of S. India have a slight ferruginous tint throughout; but we can detect no further difference. It would not appear to inhabit the sub-Himalayan region.

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* A better *average* type exists in *Ph rufus*, v Curruca rufa, *Brisson*.

† We have three Indian species of *Calamoherpe*, all distinct from those of Europe.

1. *C. brunnescens*; Agrobates brunnescens, *Jerdon* Very like the European *C. arundinaceus* (Turdus arundinaceus, *L.*; Sylvia turdoides, *Meyer*), but easily distinguished by the form of the wing, in which the second or first developed primary is constantly $\frac{1}{4}$ in. shorter than the next, and the third, fourth and fifth are subequal.

2 *C. dumetorum*, nobis, J A S. xviii. 815.

3 *C. agricola*, Jerdon, Madr. Journ xiii pt 2 p 131; J A. S xiv. 595. This much resembles the European *C. salicaria* (Motacilla salicaria, *Gmelin*; C. alnorum, *Brehm*, Mot. arundinacea, *Lightfoot*); but is readily distinguished from it, as is also *C. dumetorum*, by the same difference in the proportion of the primaries as exists in the species before cited.

The three Indian species of *Calamoherpe* accordingly tend to approximate *Phylloscopus* in the form of the wing, and they have also less aquatic habits than their European congeners.

2. Phylloscopus magnirostris, nobis, J. A. S. xii. 966.

Phyllopneuste indica, nobis, J. A. S. xiv. 593.
Ph. trochilus? apud Hodgson, Gray, Zool. Misc. 1844, p. 82.

Length 5 to $5\frac{1}{4}$ in., by $8\frac{1}{4}$ in. across: wing $2\frac{5}{8}$ to $2\frac{3}{4}$ in., its first primary measuring $\frac{3}{4}$ in., and the second being $\frac{7}{16}$ in. shorter than the third, which does not quite equal the 4th and 5th: tail 2 to $2\frac{1}{8}$ in., its two outer feathers on each side very slightly graduating. bill to gape $\frac{5}{8}$ in. · tarse $\frac{3}{4}$ in. Irides dusky. Bill dusky plumbeous above, fleshy horn-colour at base of lower mandible. Legs albescent plumbeous. Plumage, duskyish or infuscated olive-green above, having a faint tinge of tawny, especially on the wings and tail; the medial larger coverts of the wings being tipped with albescent-greenish: a narrow but conspicuous pale yellowish supercilium, and the lower ear-coverts are partly of the same hue · under parts pale; the breast tinged with ashy, mingled with faint yellowish; and the rest of the lower parts are more or less of a purer yellowish-white. The tawnyish hue of the wings and tail resembles that of the upper parts of the European *Ph. rufus*, whence the name of the latter species.

The species appears to be generally diffused over the country, and we have seen specimens from the eastern coast of the Bay of Bengal, and also one from Chusan. We have been informed that it has a pleasing song.

3. Phylloscopus lugubris, nobis, J. A. S. xii. 968.

Length $4\frac{3}{4}$ to $4\frac{7}{8}$ in., by $7\frac{1}{2}$ in. across: wing $2\frac{1}{2}$ in.; first primary $\frac{3}{4}$ to $\frac{13}{16}$ in., and the second $\frac{5}{16}$ in. shorter than the third, which does not quite equal the 4th and 5th: tail $1\frac{7}{8}$ in., subeven: bill to gape nearly $\frac{5}{8}$ in.: tarse $\frac{3}{4}$ in. Irides dusky. Bill dusky above, and also on the medial part of the lower mandible; the rest amber-coloured. Legs pale greenish-dusky. Plumage, above dusky olive-green, nearly as in the last species, but without the tawny shade; also a similar pale yellowish supercilium, and tips to the medial wing-coverts: below albescent, faintly tinged with yellow medially, and laterally with the hue of the flanks.

Common in Lower Bengal during the cold season, and more or less so over the country generally.

4. Phylloscopus affinis.

Motacilla affinis, Tickell, J. A. S ii. 576
Ph. flaveolus, nobis, *passim*.
Abrornis xanthogaster, Hodgson, Gray, Zool. Misc. 1844, p. 82.

Length $4\frac{3}{8}$ to $4\frac{1}{2}$ in., by $6\frac{1}{2}$ to 7 in. in expanse: wing $2\frac{1}{8}$ to $2\frac{3}{8}$ in.; having the first primary $\frac{3}{4}$ in., and the second $\frac{4}{16}$ in.

shorter than the third, which almost equals the 4th and 5th: tail 1¾ to 1⅞ in., its outermost and penultimate feathers very slightly graduating: bill to gape ½ in., or a trifle more: tarse ¾ in. or nearly so. Irides dark. Bill dusky above, amber-coloured below: legs pale brownish-dusky, tinged with yellow; the soles more or less yellowish. Plumage, above fuscous olive-green, with an extremely faint tawny tinge; no pale tips to the medial wing-coverts: supercilia, cheeks and under parts, pale sullied yellow, brightest on the middle of the belly, with a slight tawny tinge in some, and the breast and flanks a little infuscated.

This species might be supposed to be the young of the preceding, in corresponding yellowish garb to the young of *Ph. trochilus* and *Ph. rufus*; but on minute comparison of freshly killed specimens, they are seen to be distinct. The bill is more feeble, and much more compressed, in *Ph. affinis*; whereas in *Ph. lugubris* it is very little compressed, and the rictal setæ are considerably more developed. The colour of the legs is also very different, being in *lugubris* pale greenish-dusky, while in *affinis* there is a strong tinge of brown. From examination of a great number of specimens, we feel convinced that the colouring here described is permanent.

This species is common in Lower Bengal, more so above the tideway of the rivers, and we believe that it is generally distributed over India.

5. PHYLLOSCOPUS INDICUS.

Sylvia indica, Jerdon, Madr Journ xi 6.
Ph. griseolus, nobis, J. A S. xvi. 443.

Length 5¼ in. by 7¼ in.. wing 2⅝ in.; having the first primary ⅞ in. long, and the second ⅜ in. shorter than the third, which equals the sixth, and is scarcely shorter than the fourth and fifth: tail 2 in.: bill to gape 9⁄16 in.: tarse ¾ in. Irides very dark brown. Bill dusky above, below pale amber · interior of the mouth whitish, with scarcely a tinge of yellow. Tarse externally, and the toes above, light brown; internally and beneath, yellow. Plumage, above uniform dull ash-colour, without a tinge of green: supercilia clear pale yellow: lower parts pale dull yellowish, purer on the middle of the belly, and the rest more or less tinged with dull tawny.

This species appears to be found chiefly in the peninsula of India, and is rare in Lower Bengal.

6. PHYLLOSCOPUS FUSCATUS, nobis, J. A. S. xi. 113.

Ph. brunneus, nobis, J. A. S. xiv. 591 (the young).

Length 5 to 5¼ in., by 7⅛ to 7⅝ in.: wing 2¼ to 2⅜ in.; having the first primary $\frac{13}{16}$ to $\frac{15}{16}$ in., and the second $\frac{5}{16}$ in. shorter than the third, which equals the sixth, and is a little shorter than the fourth and fifth: tail $2\frac{1}{8}$ in., with its outermost feathers $\frac{5}{16}$ in. shorter than the middle ones: bill to gape nearly $\frac{5}{8}$ in.: tarse $\frac{7}{8}$ in. Irides dark hazel. Bill dusky above, yellowish at base of lower mandible; inside of the mouth rather pale yellow: legs greenish-brown. Plumage, above uniform olive-brown; below albescent, purest on the throat and middle of belly, and weakly tinged with a ferruginous or ruddy hue on the pale supercilia, sides of neck, flanks and lower tail-coverts, and more faintly on the breast; axillaries also weak ferruginous, with the fore part of the under surface of the wing, and the primaries are slightly margined with pale rufescent: no trace whatever of a wing-band. The young (*Ph brunneus*, nobis, *passim*) resemble the adults in colour, but the wings and tail are rather shorter, and the plumage is of somewhat more open texture.

Not rare in Lower Bengal during the cold season; but commoner, it would seem, to the eastward, and especially in Arakan.

7. PHYLLOSCOPUS VIRIDANUS, nobis, J. A. S. xii. 967*.

Abrornis tenuiceps, Hodgson, Gray, Zool. Misc. 1844, p. 83. (Perhaps *Ph trochilus* of W. India apud Gould.)

Length $4\frac{3}{4}$ to $5\frac{1}{8}$ in., by $7\frac{1}{4}$ to $7\frac{1}{2}$ in.: wing $2\frac{1}{4}$ to $2\frac{1}{2}$ in.; its first primary $\frac{5}{8}$ to $\frac{3}{4}$ in., and the second $\frac{1}{4}$ in. shorter than the third, which equals the fourth and fifth: tail $1\frac{3}{4}$ to 2 in.: bill to gape nearly $\frac{5}{8}$ in.: tarse $\frac{11}{16}$ to $\frac{3}{4}$ in. Irides dusky. Bill dusky horn-colour above, the under mandible yellowish except towards tip. Legs pale greenish-plumbeous. Plumage, above light dull olive-green, beneath greenish-albescent. a pale yellow streak over the eye; and a slight whitish bar on the wing, formed by the tips of its larger coverts.

The commonest species of the genus in Lower Bengal; and we believe generally diffused. The only sound we have heard it utter is a faint *tiss-yip* frequently repeated; but never a number of times in continuous succession, like the much louder *tsih-tseh* of the European *Ph. rufus*.

8. PHYLLOSCOPUS NITIDUS, nobis, J. A. S. xii. 965.

Muscicapa nitida?, Latham, Franklin.
Sylvia hippolais, apud Jerdon, Madr. Journ. xi. 6.
Hippolais Swainsoni, Hodgson, Gray, Zool. Misc. 1844, p. 82. (Probably *Sylvia sibilatrix* of Royle's list)

Length $4\frac{1}{2}$ to $4\frac{3}{4}$ in., by $7\frac{3}{8}$ to $7\frac{1}{2}$ in. across: wing $2\frac{3}{8}$ to $2\frac{5}{8}$ in.;

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* *Phyllopneuste rufa* apud nos, J. A S. xi. 191; and *Ph. affinis*, Ann & Mag. Nat. Hist. 1843, vol. xii. p. 98.

having the first primary $\frac{9}{16}$ to $\frac{5}{8}$ in., and the second $\frac{3}{8}$ in. shorter than the third, which equals the fourth and exceeds the fifth: tail $1\frac{7}{8}$ to 2 in.: bill to gape $\frac{5}{8}$ in.; and tarse $\frac{3}{4}$ in. Irides dark. Bill carneous-dusky, the lower mandible pale, and legs light brownish, tinged with yellow on the toes. Plumage, above of a much livelier green than in any of the preceding, resembling that of the European *Ph. sibilatrix*; below unsullied pale yellowish, brightest about the breast; and there is a pale wing-band, formed by the tips of the larger coverts of the secondaries.

This pretty species appears to be very generally distributed, but is somewhat rare in Lower Bengal.

9. PHYLLOSCOPUS TRISTIS, nobis, J. A S. xii. 966.

Sylvia trochilus, apud Jerdon, Madr. Journ. xi. 6.

Length $4\frac{1}{2}$ to 5 in. by $6\frac{1}{2}$ to $6\frac{7}{8}$ in.: of wing $2\frac{1}{8}$ to $2\frac{1}{2}$ in.; the first primary $\frac{3}{4}$ in. (in large specimens), and the second $\frac{1}{4}$ in. shorter than the third, which equals the fourth and fifth: tail $1\frac{3}{4}$ to 2 in.: bill to gape $\frac{1}{2}$ in.; and tarse $\frac{9}{16}$ to $\frac{3}{4}$ in. Irides dark. Bill blackish, tinged with yellow at base of lower mandible; and gape also yellow · legs dull black. Plumage, above uniform dull brown: below albescent, with a faint tinge of ruddy or ferruginous on the pale supercilia, sides of neck, breast and flanks; and no tinge of yellow except on the axillaries and fore part of the wing underneath, which are almost pure light yellow. Bill small and slender.

A common species, and generally diffused. We once observed it in great abundance, together with *Calamoherpe agricola*, haunting low bushes near the Calcutta salt-water lake.

10. PHYLLOSCOPUS OCCIPITALIS.

Phyllopneuste occipitalis, Jerdon, nobis, J. A. S. xiv. 593

Length $4\frac{3}{4}$ in.: of wing $2\frac{3}{8}$ in.; the first primary $\frac{3}{4}$ in., and the second $\frac{5}{16}$ in. shorter than the third, which nearly or quite equals the fourth and fifth · tail 2 in., even or squared: bill to gape $\frac{5}{8}$ in. · tarse $\frac{11}{16}$ in. Alar and caudal feathers unusually firm. Bill light dusky above, pale below: legs pale. Plumage, above mingled green and ashy, the latter prevailing on the back, the former on the rump, wings and tail; crown dusky, with whitish supercilia, and a conspicuous pale medial line, broader and tinged with yellow at the occiput: a slight but distinct yellowish-albescent wing-band; the fore part of the wing brightish green; and its margin, with the axillaries, pure light yellow. Lower parts albescent, mingled with yellowish; and very faintly tinged with ruddy. Inner webs of the three outer tail-feathers on each side narrowly bordered with white, the ante-penultimate less so.

This pretty species we have only seen from the Deyra Doon and from S. India. In colouring it approximates the groups *Reguloides* and *Abrornis*; but the remarkable firmness of its wings and tail is peculiar, and prohibitive of its association with either.

The next three species (constituting the subgroup *Reguloides*, nobis) have, like the last, a pale medial streak on the crown, and they greatly approximate the genus *Regulus* in figure and proportions, and even in colouring (minus the developed crest); but their habits are those of other *Phylloscopi*.

11. PHYLLOSCOPUS TROCHILOIDES.

Acanthiza trochiloides, Sundevall (1837)
Phyllopneuste reguloides, nobis, J. A. S. xi. 191, xii. 963 (nec *reguloides* apud Hodgson).

Length of a male $4\frac{7}{8}$ in. by $7\frac{1}{4}$ in.: wing $2\frac{1}{2}$ in.; its first primary $\frac{11}{16}$ in., and the second $\frac{3}{8}$ in. shorter than the third, which equals the fifth and is a little shorter than the fourth; but, in some, these three are equal: tail $1\frac{7}{8}$ in, even: bill to gape $\frac{5}{8}$ in., or nearly so: tarse $\frac{11}{16}$ in. Length of a female $4\frac{1}{2}$ by $6\frac{7}{8}$ in.; wing $2\frac{5}{16}$ in.; and tail $1\frac{3}{4}$ in. Irides dark. Upper mandible dusky, the lower yellow; and legs yellowish-brown tinged with plumbeous. Plumage, above dull green, a little infuscated, with two conspicuous yellowish-white bars on the wing, formed by the tips of the greater and lesser coverts: below albescent-greenish, a little tinged with yellow: a broad yellowish-white or pale yellow supercilium; and above this a broad dusky band, leaving the middle line of the crown dull green like the back, but paling at the occiput; below the supercilium the colour is also dusky: axillaries, with the fore part of the wing underneath, yellow; and the outermost and penultimate tail-feathers have a narrow whitish margin to their inner web.

Inhabits the sub-Himalayas, and visits Lower Bengal in some abundance during the cold season. We have obtained one so late as March 15th in the vicinity of Calcutta.

12. PHYLLOSCOPUS PROREGULUS.

Motacilla proregulus, Pallas.
Regulus modestus, Gould; and, in abraded plumage, *R. inornatus*, nobis, J. A. S. xi. 19, and *Ph. montanus*, Hutton, nobis, Catal. no. 1105.
Phyllopneuste nitidus, Hodgson, G. R. Gray.

Length generally about 4 to $4\frac{1}{4}$ in. by 6 to $6\frac{1}{2}$ in. across: wing

$2\frac{1}{8}$ in.; its first primary $\frac{1}{2}$ in.*, and the second not $\frac{5}{16}$ in. shorter than the third, which exceeds the sixth, and nearly or quite (in different specimens) equals the fourth and fifth: tail $1\frac{1}{2}$ to $1\frac{3}{4}$ in., even. An unusually large specimen measured $4\frac{1}{2}$ by 7 in.; wing $2\frac{1}{4}$ in.: tail $1\frac{3}{4}$ in.: bill to gape nearly $\frac{5}{8}$ in.: tarse $\frac{11}{16}$ in. Irides dark. Upper mandible dusky, the lower yellow except at tip; and legs rather pale brown, without any plumbeous tinge. Bill nearly as much compressed as in *Regulus*. Plumage, above olive-green, brightest on the rump, wings and tail: crown dusky, with a pale mesial line, sometimes well defined, but in new plumage not very distinct; and in much worn or abraded plumage it often disappears altogether, and the upper parts are then dingy grayish-brown, with scarcely a tinge of green: two conspicuous yellowish-white bars on the wing, the hinder more broad; and behind this is a dark patch, corresponding to the black seen in *Regulus*: tertiaries conspicuously margined with whitish (as more or less in *Regulus*), and secondaries and some of the primaries slightly tipped with the same: axillaries, with the fore part of the wing underneath, pale yellow: supercilia and lower parts greenish-albescent.

Common in Lower Bengal, where a few perhaps breed; but the great majority retire to the mountains for that purpose†. As an exceedingly great rarity, it has been met with in Dalmatia and in England. Habits as in other species of *Phylloscopus*, and not (as in *Regulus*) gregarious: song-note nearly similar to that of *Ph. sibilatrix*, but considerably weaker.

13. PHYLLOSCOPUS CHLORONOTUS.

Abrornis chloronotus, Hodgson, Gray's Zool. Misc. p 82; G. R. Gray, 'Appendix to Catalogue of Specimens presented by Mr Hodgson to the British Museum,' p 152; v *Regulus modestus* apud Hodgson.

Resembles the last, but is smaller, with bill conspicuously shorter and darker-coloured, and the rump pale canary-yellow, strongly contrasting with the hue of the back; the median coronal line much more conspicuous, and the pale margins of the tertiaries less so. Its size is that of the European *Regulus cristatus*.

Length $3\frac{1}{2}$ in., or a trifle more: wing $1\frac{7}{8}$ to 2 in.; its first primary $\frac{9}{16}$ in., the second $\frac{1}{4}$ in. shorter than the third, which does not equal the fourth and fifth. bill to gape about $\frac{1}{2}$ in., and tarse $\frac{5}{8}$ in.: tail $1\frac{1}{4}$ in. to $1\frac{5}{8}$ in. Upper mandible blackish, the lower pale except towards tip. Legs pale. In other respects like the last, from which it is at once distinguished by its pale pure yellow rump.

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* In one only, of several specimens, $\frac{3}{8}$ in.

† A reputed nest, taken near Calcutta, is described J. A. S. xii. note to p. 965.

This minute species appears to be peculiar to the sub-Himalayan region, where it is extensively distributed.

II. Genus Regulus (antiq.), Cuvier.

Capt. Hutton states that both *R. ignicapillus* and *R. cristatus* of Europe inhabit the N.W. Himalaya. We have seen only a single male specimen, procured by Capt. Thomas at Simla; and this perfectly resembles *R. cristatus*, except in being considerably larger, and the fine flame-coloured interior crest would seem to be more developed. Length of wing 2⅜ in., and of tail 1⅝ in. In several British specimens of *R. cristatus*, the corresponding measurements are 2 in. and 1⅝ in., with the rest in proportion. Should this difference in size prove constant, the race might be denominated *R. himalayensis*; requiring, however, to be first minutely compared with the N. American *R. satrapa*, Lichtenstein (v. *tricolor*, Jardine). Mr. Hodgson would not appear to have met with a true *Regulus* in Nepal.

III. Genus Culicipeta, nobis, J. A. S. xii. 968.

"General structure of *Phylloscopus*, but having a narrow Flycatcher's bill and armature of rictus, the ridge of the upper mandible angulated, and the breadth of the bill evenly attenuating." Such are the characters of the first or typical species, to which may be added that the claws, especially that of the hind toe, are longer and less curved. In other species, however, the form grades to that of *Phylloscopus*; but there is a general and marked resemblance of colouring throughout the series, indicative of their unity as a group, and which would help to separate it from the European type, *Phyllopneuste* (v. *Hippolais*). In general, the upper parts are green, the lower bright yellow wholly or in part, and the crown exhibits the colouring (variously modified) of *Phylloscopus occipitalis* and of the subgroup *Reguloides*; while the two or three outer tail-feathers are, in most of the species, largely marked with white on the inner web. Their habits appear to be quite similar to those of the *Phylloscopi*.

1. Culicipeta Burkii.

Sylvia Burkii, Burton, P. Z. S. 1835, p. 153.
Acanthiza arrogans, Sundevall (1837)
Cryptolopha auricapilla, Swainson, 2½ Centen (1837).
Muscicapa bilineata, Lesson, Rev. Zool. de la Soc. Cuv. 1839, p. 104.

Length 4⅜ by 6½ in.: wing 2¼ in.; its first primary ¾ in., and the second ⅜ in. shorter than the third, which equals the sixth or seventh (in different specimens), and is rather shorter than the intervening two or three: tail $1\frac{3}{4}$ in.: bill to gape exceeding $\frac{1}{2}$ in.; and tarse $\frac{11}{16}$ in. Irides dark. Bill dusky above; underneath, with the legs, pale amber or brownish-yellow, darker on toes. Plumage, above bright yellowish olive-green; below full siskin-yellow throughout; the cheeks and sides of neck intermediate: over each eye a broad black streak reaching to the occiput, leaving the middle of the head greenish, slightly flanked with ash-gray: tail dusky, its middle feathers margined with the hue of the back, and the inner web of the outermost white nearly throughout, as also the terminal half of that of the next. Some have a slight yellowish wing-band, which in others is barely indicated.

This pretty little bird is not uncommon in Lower Bengal during the cold season, and like the rest of its tribe retires to the sub-Himalayan region to breed. Its bill has more decidedly the Flycatcher form than any of the following.

2. CULICIPETA CANTATOR.

Motacilla cantator, Tickell, J A. S. ii. 576.

C. schisticeps, Hodgson, Gray's Zool. Misc. 1844, p 82; G R. Gray, 'Appendix to Catalogue of Specimens presented by Mr. Hodgson to the British Museum,' p. 153.

Length $4\frac{1}{4}$ in., by $6\frac{3}{8}$ in. expanse: wing $2\frac{1}{4}$ in.; with primaries as in *C. Burkii*: tail $1\frac{3}{4}$ in.: bill to gape nearly $\frac{5}{8}$ in.; and tarse $\frac{5}{8}$ in. Irides dark. Bill light dusky above, amber-coloured below: legs light yellowish-carneous, with a leaden tinge. Plumage, bright olive-green above, yellower on the wings and tail: throat, cheeks, supercilia, lower tail-coverts, and margin of wing, bright yellow; the belly and flanks grayish-white: greater wing-coverts tipped with pale yellow, forming a slight bar on the wing: on each side of the crown a broad black band; and an intermediate narrow greenish one, becoming yellower upon the occiput: upper tertiaries very slightly margined at the tips with yellowish-white; and the tail-feathers have a narrow yellowish-white internal border.

This pretty species is rare in Lower Bengal, becoming commoner to the westward. The bill is narrower and the rictal setæ are less developed, while the claws (especially that of the hind-toe) are shorter and more curved than in *C. Burkii*.

3. CULICIPETA PULCHRA.

Abrornis pulcher, Hodgson, nobis, J. A. S. xiv. 592.

Abr. erochroa (?), Hodgson, Gray, Zool Misc. 1844, p. 82 (undescribed); G. R. Gray, Appendix to Catalogue, p. 152.

Length $4\frac{1}{4}$ in., of wing $2\frac{1}{8}$ in., with primaries as in *C. Burkii*: tail $1\frac{3}{4}$ in.: bill to gape $\frac{1}{2}$ in.; and tarse nearly $\frac{3}{4}$ in. Bill dusky above, below yellow or amber-coloured; and tarse pale. Plumage, above dull olive-green, brighter on the rump and margins of the wing and tail-feathers, those of the primaries yellowish, and a pale rufescent bar across the wing: two broad black streaks on the crown, and between them a dull greenish streak flanked with ashy: supercilia also dull green; but the orbital feathers are yellow; and the entire under-parts are pale dull yellow, or albescent-yellowish, becoming of a deeper yellow on the belly and lower tail-coverts: tail having its *three* outer feathers wholly white, save the terminal half of their outer web, together with the tip of the inner web of the ante-penultimate and slightly of the penultimate.

Inhabits the Nepal and Sikkim Himalaya*.

4. CULICIPETA SCHISTICEPS.

Abrornis schisticeps, Hodgson, nobis, J. A S. xiv 592.
Phyllopneuste xanthoschistos, Hodgson, Gray, Zool. Misc. 1844, p. 82 (undescribed); G R. Gray, 'Appendix to Catalogue,' p 151.

Length $4\frac{1}{4}$ in.: of wing $2\frac{1}{4}$ in., with primaries as in *C. Burkii*. tail $1\frac{5}{8}$ in.: bill to gape $\frac{5}{8}$ in., and tarse $\frac{5}{8}$ in. Bill dusky above, below amber-coloured; and feet apparently pale brownish-plumbeous. Plumage, above pale ashy, passing to greenish-yellow on the rump, wings and tail. below, with the cheeks and lower half of the ear-coverts, wholly bright yellow: a whitish-gray supercilium and narrow medial streak upon the crown, and two broad ill-defined lateral streaks of rather a more dusky gray than that of the back: outermost and penultimate tail-feathers only, white on their inner webs. The young have looser plumage and all the colours less intense.

This appears to be very common throughout the sub-Himalayan territories, and is likewise met with in Arakan; but it appears never to descend from the hills. According to Capt. Hutton, it is a common species at 5000 ft. elevation, and commences building in March. The nest would appear to resemble those of *Phylloscopus trochilus* and *Ph. rufus*. Eggs spotless white. Vide Hutton, in J. A. S. xvii. pt. ii. p. 688.

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* Mr G. R. Gray suggests that this may be the young of his *Abr erochroa*, Hodgson, which he thus describes:—

"Length 5 in; bill from gape $\frac{1}{2}$ in.; tarse $\frac{3}{4}$ in.: wings under $2\frac{1}{2}$ in. Upper surface olive-green, a streak over each eye from the nostrils, under surface and lower part of back, yellowish-white, brightest on the back [rump?] and vent: wings with the tips of the greater coverts broadly margined with rufous-white: quills brownish-black, narrowly margined with yellowish-green · tail slaty-brown, margined with yellowish-green, the outer feathers principally white."

We suspect that this description merely refers to a fine specimen of *C. pulchra*; and may remark that the present is the only species of the series of which the Society possesses but an indifferent specimen. Of the rest, *C. castaneoceps* we have never seen; but all of the others, save four, we here describe from *recent specimens* shot near Calcutta! The four exceptions are—*Phylloscopus occipitalis* and *Ph. chloronotus*, and the two *Culicipetæ* which next follow; and to these may be added the *Regulus*.

5. CULICIPETA POLIOGENYS, nobis, J. A. S. xvi. 441.

Length $4\frac{1}{4}$ in.; of wing $2\frac{1}{8}$ in., with the outermost primary $\frac{5}{8}$ in. long, the second exceeding it by $\frac{9}{16}$ in., and the third $\frac{1}{8}$ in. shorter than the fourth, which equals the fifth and sixth: tail $1\frac{5}{8}$ in.; bill to gape $\frac{9}{16}$ in.; and tarse $\frac{5}{8}$ in. Bill dusky above, yellow or amber-coloured below. Legs pale. Plumage, above dark olive-green, slightly yellowish on rump, with a conspicuous narrow yellowish-white wing-band: crown and ear-coverts dusky-gray, with blackish coronal bands; the chin, and feathers proceeding from the base of the lower mandible, grayish-white: rest of the lower parts bright yellow: tail with its three outer feathers white on the inner web, as in *C. pulchra*.

We have only seen this well-marked species from Sikkim. It might be mistaken for the preceding on a very superficial view; but besides the differences in the details of colouring, its wings are much more rounded and the bill is somewhat less compressed.

6. CULICIPETA CASTANEOCEPS.

Abrornis castaniceps, Hodgson, nobis, J. A. S. xiv. 593.
Abr. castaneoceps, H., Gray, Zool. Misc. 1844, p. 82; G. R. Gray, 'Appendix to Catalogue,' p. 152.

"Length $4\frac{1}{4}$ in.: wing nearly 2 in.: bill to gape above $\frac{5}{8}$ in.: tarse $\frac{5}{8}$ in. Upper surface olive-green: front and top of head pale rufous-chestnut; hind-head and nape grayish-slate. Lower part of back and abdomen bright yellow: throat white: wings and tail brownish-black, margined with yellowish-green: greater coverts of the wings tipped with yellow, forming two bands."—*G. R. Gray.*

"Above vernal green: belly, vent, and croup, deep yellow. Chin to belly white, passing laterally to soft plumbeous. Top of head chestnut, bounded by black to sides. Bill and legs pale. Length 4 in.: wing $1\frac{15}{16}$ in.: tail $1\frac{5}{8}$ in.: bill to forehead $\frac{3}{8}$ in.: tarse $\frac{3}{4}$ in."—*Hodgson.*

Procured by Mr. Hodgson in Nepal. We have never seen a specimen.

Finally, may be noticed a Javanese species of this group.

7. CULICIPETA TRIVIRGATA.

Sylvia trivirgata, Temminck, Verreaux MS.
Phylloscopus trivirgatus, Strickland, figured and described in Sir W. Jardine's 'Contributions to Ornithology,' November 1849.

"Length 4 in.; of wing 2 in. 2 l.; middle tail-feathers 1 in. 8 l.; outermost $1\frac{1}{2}$ in.: bill to gape 5 l.; tarse 7 l.

"In plumage it greatly resembles the broader-billed but closely allied *C. Burkii* of India. Middle of crown olive-yellow, which occupies the inner webs of the feathers, the outer webs being deep fuscous, nearly black, with an olive tinge, forming a broad dark stripe on each side of the crown: between this and the eye is a superciliary streak of clear yellow · a streak of fuscous passes through the eye; the cheeks, throat, and lower parts are bright yellow, with an olive tinge; back and wings yellowish-olive: beak horn-coloured, the base of lower mandible pale; and legs brown.

"Inhabits the island of Java."—Strickland.

XVI.—*On Fossil Echinoderms from the Island of Malta, with Notes on the stratigraphical distribution of the Fossil Organisms in the Maltese beds.* By Thomas Wright, M.D. &c., Professor of the Natural Sciences in the Cheltenham Grammar School.

[Continued from p. 127.]

Family Spatangidæ.

The general outline of the Urchins of this family is oval, oblong or cordiform, and they satisfactorily exhibit the bilateral symmetry of the *Echinidæ*. The mouth is anterior, bilabiate, and edentulous. The anal opening is posterior and supramarginal, and is closed by a complicated series of small plates. The apices of the ambulacral areas are united at the summit of the test. The anterior single ambulacrum has a different structure from the antero- and postero-lateral pairs, and is in general lodged in a depression of the test, which extends to the anterior border forming the anteal sulcus; the test is extremely thin, and is covered with small tubercles which support hair-like spines; besides these there are some larger crenulated and perforated tubercles which support large spines. There are two or four genital pores which are sometimes placed close together, but are in other genera apart. The eye-plates are five in number, and are placed at the apices of the ambulacra in a pentagonal form around the genital plates. We observe on the surface of the test of some *Spatangidæ*, certain delicate lines called *fascioles*, having a smoother appearance than the tubercular surface of the test; they are furrows which are strewed with microscopic tubercles destined to carry very delicate spines, which, when seen under the microscope, appear to have the same structure as the *Pedicellariæ*. The fascioles have a different disposition in each genus, and afford a good character in giving definitions of the same; when the fasciole surrounds the ambulacral petals like an undulating groove, as in *Hemiaster*, *Schizaster*, &c., it is said to be a *peripetal*; when it surrounds the single ambulacrum, as in *Amphidetus*, it is *internal*; when it extends along the sides, as in *Schizaster*, it is *lateral*; when it surrounds the circumference of the test, as in *Pericosmus*, it is *marginal*; when it is limited to the base of the anal opening, it is *subanal*. We find sometimes in the same genus more fascioles than one, thus the subanal and peripetal are frequently associated together.

Genus SPATANGUS (Klein, 1734).

Urchins, in general large with a thin test, a convex dorsal surface, and the antero-lateral and postero-lateral ambulacral areas composed of larger petals than in other *Spatangidæ*. The anterior ambulacrum is lodged in a deep anteal sulcus; the upper part of the anterior border of the antero-laterals is obliterated towards the summit.

Numerous very large crenulated and perforated tubercles are scattered over the surface of the ambulacral plates. They have a deeply grooved subanal fasciole; only four genital pores, the anterior pair more closely approached than the posterior pair.

Five perforated ocular plates, arranged in the form of a pentagon, around the genital pores. A tube or hollow cone at the internal part of the single interambulacrum. A large vertical plate passing into a cone arises from the internal surface of the test upon the left side of the mouth, and is directed obliquely upwards and backwards.

The species are living or fossil in the tertiary rocks.

Spatangus Hoffmanni, Goldfuss.

SYN. *Spatangus Hoffmanni*, Goldf. Petrefacta, Band i. p. 152. tab. 47. fig. 3 *a*, *b*, *c*; Desmoulins, Etudes sur les Echinides, p. 398. no. 35; Grateloup, Mém. Echinid. Foss. tab. 1. fig. 8. p. 73; Agassiz and Desor, Ann. Sc. Nat. tom. viii. p. 7.

Echinus (*petrefactus*), Scilla, Corp. Mar. pl. 10. fig. 1.

Test convex, depressed anteriorly, elevated and carinated posteriorly; antero-lateral and postero-lateral interambulacra with numerous large, perforated and crenulated tubercles, surrounded by deep sunken areolas; base convex, the postero-lateral areas with large tubercles; interambulacrum forming a tumid projection at the base; mouth and anus large; marginal fold acute; the pores in the zones large, disposed in wide-set pairs.

Dimensions.— Antero-posterior diameter $2\frac{2}{10}$ inches, transverse diameter 2 inches; height anteriorly $\frac{7}{10}$ths of an inch, height posteriorly $\frac{17}{20}$ths of an inch.

Description.—The characters of this form of *Spatangus* are so prominent and well defined, that one is astonished that between the time of Scilla, who first figured it, and that of Goldfuss, who first described it, no zoophytologist should have become its historian. The dorsal surface of the test is broad, convex, and depressed anteriorly, and narrow, elevated, and carinated posteriorly; the ambulacral areas are well defined, the single ambulacrum with its rudimentary pores is lodged in a wide but shallow anteal sulcus, and there is a flattened plateau between the sulcus and the apical disc; in this region the obsolete pores are clearly seen. the antero-lateral ambulacral areas extend outwards at an angle of 24° from a transverse line drawn through the apical disc*: the posterior poriferous zone extends two-thirds of the distance between the disc and the border, the anterior zone commences much farther from the disc above, but extends as far as the posterior zone below, thus in the specimen before us, there are fourteen pairs of pores in the posterior, and only nine in the anterior zone: the postero-lateral ambulacral areas extend backwards, and towards their termination they curve gracefully outwards; the angle they form at the transverse line at the disc is 62°, and there are twenty pairs of pores in each of the zones. Each of the interambulacral areas presents peculiar characters; the antero-lateral pair are the smallest, and the postero-lateral are the largest, they are both remarkable for the tubercles they support on their dorsal surface; in the anterior pair there are nine, and in the posterior pair there are fourteen of these tubercles on each side of the test, which are sculptured out of the substance of the plates; as they do not project beyond the general surface of the shell, each tubercle is seated on a cylinder, which is surrounded by a deep, wide depression: as these perforations are not arranged with much regularity, the test has the appearance of having been bored by some marine mollusk. The tubercles themselves, in proportion to the size of the supporting cylinder and encircling entrenchment, are small and perforated; the single interambulacrum is narrow and elongated, and rises in the mesial line into a prominent elevated ridge; the posterior border is obliquely truncated downwards and inwards, in the upper part of this space the large anal opening is situated;

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* It may be as well to state, that we have adopted this mode of measuring the amount of divergence of the antero-lateral and postero-lateral areas rather than the vague expressions formerly in use. The angle is measured from a transverse line which cuts the longitudinal axis at right angles at the apical disc; we have found the degree of divergence to be very uniform in each species

below, the interambulacrum forms another prominence marked by two concave depressions on each side thereof, from which a wide, gently sloping central space occupies the middle of the ventral surface, having the large transversely-oblong mouth-opening with its projecting posterior lip occupying the anterior third of the base; on the sides of this sloping central space the basal portions of the postero-lateral interambulacra are thickly studded wit large slanting perforated tubercles, arranged with much regularity in this region, and a few smaller tubercles are scattered over the basal portion of the antero-lateral pair; the crescentic depressions below the anus have each a group of perforated tubercles, and between them and the smooth central concave portion of the base is the subanal fasciole, which forms a transverse band in the middle, and a crescent on each side, the upper cornua of which approaches the anal opening; below the fasciole there is another group of small perforated tubercles and a copious granulation; the crescentic depressions, subanal fasciole, and this group form together a triangle, the base of which lies before the anus, and its apex points towards the mouth; around this opening five pair of short poriferous zones indicate the termination of the ambulacral areas.

Affinities and differences.—The form of the ambulacral areas, the shortness of the anterior poriferous zone, and the size and depth of the areolar spaces around the cylinders of the large tubercles, together with the carinated elevation in the middle of the interambulacrum, form a group of organic characters which sufficiently distinguish this species from its congeners. In *Spatangus Desmarestii*, which is found with *S. Hoffmanni* in the same beds in Westphalia, the size of the test, the absence of very deep areolas on the dorsal surface, the equal length of the poriferous zones of the anterior ambulacra, and the much smaller tubercles at the base, easily enable us to distinguish it from *S. Hoffmanni*.

Stratigraphical range and localities.—It is found at Malta in bed No. 4, the calcareous sandstone, and in Westphalia; it has been collected from the Miocene at Doberg near Bünde, and at Astrapp near Osnabruck.

Spatangus De Koninckii, Wright, n. sp.

Test cordate, depressed before, elevated behind by the development of dorsal and basal median carinæ on the single interambulacrum; ambulacral areas short and broadly petaloid; anteal sulcus slight; depression of the single ambulacrum inconsiderable; several large tubercles between the petaloidal ambulacra; posterior border obliquely truncated downwards and forwards; anal opening large and circular; basal tubercles of moderate size; basal portions of the postero-lateral ambulacra form two smooth tracks destitute of tubercles between the posterior border and the mouth.

Dimensions.—Antero-posterior diameter $1\frac{6}{10}$ inch; transverse diameter $1\frac{4}{10}$ inch; height at the interambulacrum $\frac{17}{20}$ths of an inch.

Description.—An imperfect specimen of this Urchin was at first mistaken for a small variety of *Spatangus Desmarestii*, Goldf., and entered under that name in the list of fossils from bed No. 2. Having lately obtained a better specimen of this form, we are now enabled to give a description of it, which will be found to differ in many essential points from that species, to which it was at first referred. The test is regularly cordate, slightly flattened at the cheeks, bulging out at the sides, and from thence tapering abruptly towards the posterior border, where it is truncated obliquely downwards and forwards; the anterior part of the test is flattened and depressed, and the posterior portion much elevated, from the circumstance of the single interambulacrum forming two prominent ridges, one on the dorsal, and the other on the basal surface, which gives increased depth to the test, tilts it up, and forms an inclined plane of the dorsal surface. The petaloidal ambulacra are short, broad and leaf-like; the anterior pair are slightly flexed forwards and form an angle of about 15°; their anterior poriferous zone is nearly as complete as the posterior zone, which contain respectively sixteen and eighteen pairs of pores; the posterior pair form two oval leaflets, the bases and apices of which are nearly equally curved, and closed with pores, having about eighteen pairs of pores in each zone; they describe an angle of about 60°. The single anterior ambulacrum makes a very slight depression on the upper part of the anterior region, and the anteal sulcus formed by it is inconsiderable when compared with other congeneric forms; the anterior and lateral pairs of interambulacra carry a few large crenulated and perforated tubercles on the upper part of their dorsal surface; on the anterior pair there are from seven to eight, and on the posterior pair from four to five of these tubercles, which are neither so large nor yet have such deep areolas as their homologues in *S. Hoffmanni*. The single posterior interambulacrum is narrow, but greatly developed in the vertical diameter; above, a blunt prominent ridge commences near the apical disc and extends to the posterior border; below, another ridge commences a short distance from the truncated portion of the border, and extends to the centre of the mouth; the base is slightly convex from side to side, besides being raised in the middle of its posterior part by the ridge just alluded to. The tubercles on the basal portions of the anterior and posterior interambulacra are not very large, but are disposed with great regularity; those on the ridge-like prominence of the single interambulacrum are arranged in lines which radiate in all directions from a point; those on the pairs gradually decrease in size from the mouth to the border; between these two groups of tubercles there is on each side a smooth track, corresponding with the course of the postero-lateral ambulacra from the border to the mouth: the anus is large and circular, and occupies the upper part of the posterior border, the subanal fasciole is denuded; the mouth is likewise large and transversely oval, and is situated near the anteal sulcus. The apical disc is excentral, being situated about the anterior part of the middle third of the test; it is small, and is perforated with four genital holes. The superficial layer of the calcareous plates, which carries all the fine sculpture of the test, is almost entirely denuded from the dorsal surface, one or two fragments alone remain to show that the tuberculation was minute and close-set.

Affinities and differences.—This species is distinguished from *S. Hoffmanni* by the excessive elevation of the posterior part of the test; by the shorter, wider and more oval form of the petaloid ambulacra; by the poriferous zones of the anterior pair being more complete; by the large dorsal tubercles being smaller and fewer in number; by having a less impressed anteal sulcus; a convex base, with smaller tubercles; a ridge-like projection, with a regular tuberculation of the basal portion of the interambulacrum, with smooth naked ambulacral tracks on each side thereof. From *S. Desmarestii* it is distinguished by its short, broad, petaloidal ambulacra, which are long and attenuated in *S. Desmarestii*; by the greater size, number and regularity of the large dorsal tubercles, which are few, small and scattered in *S. Desmarestii*; the posterior region is not at all elevated in *S. Desmarestii*, and the anus is transversely oblong, whilst in *S. De Koninckii* the posterior part is much elevated, and the anal opening is round.

S. Desmarestii has a few groups of large tubercles on the upper part of the single interambulacrum, which are entirely absent both in *S. Hoffmanni* and *S. De Koninckii*. The basal region is so much covered up with matrix in the specimen of *S. Desmarestii* before us, that we cannot institute a comparison between this portion of its test and that of *S. De Koninckii*.

Locality and stratigraphical range.—The two or three specimens we have seen in the Earl Ducie's cabinet were collected from the clay bed No. 2 at Malta; they have all a deep ferruginous colour, and are not well preserved. We dedicate this species to our friend Dr. De Koninck of Liège, the learned author of several memoirs on the palæontology of the carboniferous rocks of Belgium.

Genus Brissus (Klein, 1734).

Form oval; the ambulacral summit excentral, and situated near the anterior border; the antero- and postero-lateral ambulacral areas straight, and lodged in shallow depressions of the test; the anterior pair are nearly transverse, the posterior pair deviating slightly from the longitudinal direction. The single ambulacrum very simple in structure; no anteal sulcus; the peripetal fasciole very sinuous; mouth large, labiate, and near the anterior border; anal opening large, situated in the middle of the posterior surface; the subanal fasciole approximated close to the anus. Four genital pores, the anterior pair smaller and nearer each other than the posterior pair. The madreporiform tubercle situated between the posterior genital openings; five perforated ocular plates placed before the genital pores and alternating with them. This genus contains a greater number of living than of fossil species; the existing forms are limited to the seas of warm latitudes; the fossil species are found only in the tertiary rocks.

Brissus latus (Wright, n. sp.). Pl. V. fig. 1 *a–c*.

Test convex and much depressed above; transverse and antero-posterior diameters nearly equal; ambulacral areas of nearly equal length; the single ambulacrum lodged in a deep anteal sulcus; antero-lateral pair curved gently forwards; peripetal fasciole very zigzag and angular; apical disc $\frac{3}{10}$ths of an inch before the centre of the disc; base slightly convex; sternal process of the single interambulacrum raised before the anus, having a central elevated ridge and numerous large tubercles arranged in regular order on its surface; subanal fasciole enclosing a space $1\frac{7}{10}$ inch in diameter; anus situated in an oblique truncation below the margin; mouth $\frac{7}{10}$ths of an inch from the anterior border; the large tubercles of moderate size.

Dimensions.—Antero-posterior diameter $4\frac{1}{20}$ inches, transverse diameter $3\frac{9}{10}$ inches; height at the vertex 1 inch.

Description.—This *Brissus* is readily recognized by its broad and depressed dorsal surface; the ambulacral areas form deep depressions in the test; the single ambulacral area lies in an inconsiderable valley on the dorsal surface, but forms rather a deep anteal sulcus; the antero-lateral pair curve gently outwards and forwards, forming an angle of 21°, with the transverse line at right angles with the longitudinal axis of the test; the postero-lateral pair are directed obliquely backwards at an angle of 55°; both pairs lie in rather deep valleys, and the poriferous zones contain from twenty-eight to thirty pairs of pores in each avenue. The peripetal fasciole (1 *a*) makes an angular zigzag track, closely embracing the apices of the ambulacral areas. In the space which it bounds on the fore part of the shell, having for its base the antero-lateral areas, and its apex the anteal sulcus of the single ambulacrum, a number of large perforated tubercles set on crenulated eminences are arranged in groups (1 *c*), the areolas of these tubercles are surrounded by small granules, and amongst them smaller tubercles are interposed; a few large tubercles occupy the angles between the apices of the antero-lateral and postero-lateral pairs, and likewise in the angle formed between the postero-laterals themselves; the rest of the dorsal surface is covered with small tubercles closely set together; each tubercle is perforated and raised on a crenulated eminence (1 *c*), and surrounded by a smooth depressed areola; the base is slightly convex; the sternal portion of the single interambulacrum is rather prominent behind, but slopes gently towards the mouth; it has an elevated ridge in the centre, and is covered with tubercles of a larger size than those of the upper surface, and which are arranged in regular rows. The subanal fasciole is of considerable extent, it forms a semicircle which passes across the most prominent part of the base, and sends its cornua upwards at a considerable distance from the anus; the basal portions of the pairs of the interambulacral areas are covered with tubercles similar to those on the sternal part; a naked track corresponding to the postero-lateral areas separates these tuberculated portions of the base. The mouth is situated near the anterior border, it is widest in the transverse diameter, and has a thick projecting under lip; the terminations of the ambulacral areas surround the mouth, and form poriferous zones around that opening: the anus is situated beneath the margin in an oblique truncation of the posterior border; the opening is much crushed in our specimen, so that its form is not discernible. The apical disc (1 *b*) is placed near the centre of the back, about $\frac{5}{10}$ths of an inch before that point: the madreporiform tubercle is small and pyriform, and is situated behind the four genital pores: the margin of the shell is thin and acute.

Affinities and differences.—The breadth of the test and the depression of the dorsal surface thereof, with the curve forwards in the ambulacral areas, and the depth of the anteal sulcus, form a group of characters by which *Brissus latus* is readily distinguished from its congeners. Out of the seven fossil species, registered but not described in Agassiz and Desor's Catalogue, two only are figured, and for this reason we are unable to make a comparison with them.

Locality and stratigraphical range.—Only one specimen of this species, in the Earl Ducie's cabinet, was collected from bed No. 1, the Gozo marble, at Malta, so that we conclude the species is rare, as it is not contained in either of the other collections of Maltese Urchins examined by us. The Jermyn Street Museum contains a specimen, which is supposed to be identical with this form.

Brissus imbricatus (Wright, n. sp.).

Test oblong, much depressed; no anteal sulcus; peripetal fasciole narrow, lodged in a groove; rest of the dorsal surface fractured; base convex; mouth large, and situated near the anterior border; sternal portion of the interambulacrum with a regular ornamentation. The subanal fasciole very near the anus is heart-shaped and narrow; it encloses rows of tubercles which are arranged in radii in regular order; before the fasciole the test forms a projection, and from the summit thereof, rows of tubercles arranged in straight lines extend towards the mouth, increasing in size as they approach that opening; the basal portions of the other interambulacral areas are covered with scale-like imbricated plates, each carrying an oval eminence with a crenulated summit, and a tubercle placed at the anterior side of the oval eminence; these tubercles are all regularly arranged in rows which have a direction forwards and outwards · the postero-lateral ambulacra form a naked space, which separates the imbricated basal portions of the pairs of interambulacra from the ornamented sternal portion of the single one. The anus is large and situated at the posterior border; both this opening and the mouth are much injured.

Dimensions.—Antero-posterior diameter $8\frac{5}{10}$ inches, transverse diameter 3 inches, height $\frac{8}{10}$ths of an inch.

Description.—The detailed diagnosis given of this species contains nearly all that we can describe of this *Brissus*, for, with the exception of a small portion of its anterior part preserving a portion of the peripetal fasciole, all the rest is absent; the regularity in the arrangement of the tubercles at the base constitutes a characteristic feature of this form, and the imbricated style of the basal plates, resembling the tegumentary membrane of a placoid fish, gives value to the specific name.

Affinities and differences.—The order and symmetry of the decoration of the sternal portion of the interambulacrum, the heart-shaped subanal fasciole, with its broad band of microscopic granules, and the leaf-like tuberculated expansion which extends from the apex of the fasciole, are very characteristic of this species; if to these we add the imbricated style of the plates occupying the sides of the base, and the oblique way the tubercles are set on their oblong bases, we have an assemblage of organic characters by which *B. imbricatus* may be readily distinguished from its congeners. The form of the test, the size of the tubercles, the symmetry of the subanal rosette, formed by radii of tubercles, and encircled by a broad fasciole, readily separate it from *B latus*, with which it is associated in the same stratum.

Locality and stratigraphical position.—This species was collected from bed No. 1, the Gozo marble, at Malta · it is the property of the Bristol Institution.

Brissus oblongus (Forbes MSS., n. sp.). Pl. V. fig. 2 *a–c*.

Test oblong, depressed before, elevated behind, dorsal surface convex; anterior border rounded, with a slight anteal sulcus; antero-lateral ambulacral areas slightly bent forwards, and nearly forming right angles with the longitudinal axis; postero-lateral ambulacra make an angle of 68°; the anterior are shorter than the posterior pair; posterior border produced and truncated: anus large, oval, and placed high up . base convex, sternal portion prominent, greatest width across the base of the postero-lateral ambulacra.

Dimensions.—Antero-posterior diameter $2\frac{1}{10}$ inch, transverse diameter $1\frac{9}{20}$ inch, height $1\frac{1}{10}$ inch.

Description.—This small *Brissus* has an oblong form, and is rounded before and truncated behind; the anterior half of the test is more depressed than the posterior half; the single interambulacrum rises into a ridge-like eminence on the back, and the sternal portion thereof is much inflated at the base, so that the greatest height of the test is in this region. The antero-lateral ambulacra (2 *a*) are shorter than the posterior pair, and are extended across the test nearly at right angles to the longitudinal axis; the postero-lateral ambulacra are longer than the anterior, and form angles of 68°; the petaloid portions of both areas are depressed; the anterior pair have eighteen pairs of pores, the posterior pair have twenty-four pairs of pores in their poriferous zones: the single ambulacrum is not lodged in a rudimentary anteal sulcus, and is nearly on a level with the contour of the test, the front and cheeks of which are convex, with four groups of larger tubercles in this region; the sides slope obliquely downwards to the border, which is obtuse: the single interambulacrum is raised into a ridge above, and produced into a blunted caudal process, obliquely truncated behind: the base (2 *b*) is convex, chiefly from the arched form which the sternal portion of the interambulacrum assumes: the mouth is large, near the anterior third of the base: the anus is of an elliptical form, and occupies more than the upper half of the truncated portion of the posterior border. The peripetal fasciole (2 *a*) closely embraces the ambulacral pairs, and makes three angles in passing over the anterior interambulacra; the subanal fasciole (2 *b*) describes a heart-shaped outline, its base is near the anus, and its apex touches the prominent point of the sternum; the space thereby circumscribed is filled with tubercles having a definite arrangement. The apical disc is small, with four genital pores, the posterior pair being much larger than the anterior pair, the tubercles (2 *c*) on the anterior interambulacra are much the largest, those on the rest of the back are small and very uniform in size, whilst those on the sternum and the sides of the base are intermediate in size; the basal tracts of the ambulacral areas are destitute of tubercles; as they approach the mouth they are again perforated with a single row of holes; those of the antero-laterals extend as far as the border, whilst the single and posterior pair have only two or three pairs of their plates perforated.

Genus Brissopsis (Agassiz, 1840).

Form elongated, subcylindrical, ambulacral areas straight, short, and wide, converging near the summit of the test; peripetal fasciole flexuous, closely surrounding the ambulacral areas; two or four genital pores, the posterior larger than the anterior pair; five ocular plates disposed nearly equally apart in a pentagonal form around the genital openings; subanal fasciole wide, and situate at a considerable distance below the anal opening; single ambulacrum lodged in an anteal sulcus; the basal portions of the ambulacra are wide and naked; the tubercles are very uniform in size, and are crenulated and perforated. Three living species; the rest are fossil in the tertiary rocks.

Brissopsis Duciei (Wright, n. sp.). Pl. VI. fig. 1 *a–e*.

Test oblong, depressed anteriorly, elevated posteriorly; apical disc central; ambulacral areas forming concave depressions; single ambulacrum the longest and widest; antero-lateral pair straight, angle of inclination 34°; postero-lateral shorter, angle of inclination 55°; peripetal fasciole broad and undulating; anus oval, large, situated high on the border; base concealed; dorsal tubercles small, nearly of a uniform size, except on the sides and the anterior part, where they are larger.

Dimensions. — Large specimen. Antero-posterior diameter $3\frac{4}{10}$ inches, transverse diameter $3\frac{2}{10}$ inches: height cannot be accurately measured.

Small specimen. Antero-posterior diameter $1\frac{9}{10}$ inch, transverse diameter $1\frac{17}{20}$ inch; height over the middle of the single ambulacrum $\frac{9}{10}$ths of an inch, at the highest point of the dorsal region $1\frac{1}{10}$ inch.

Description.—This beautiful Urchin is one of the most typical forms of the group to which it naturally belongs. The test is oblong and inclined, from the height of the anterior third being less by $\frac{2}{10}$ths of an inch than the posterior third; the ambulacral areas are all well developed, and arranged in the form of a St. Andrew's cross; as the apical disc is situated near the centre of the body, the regularity of their arrangement forms a conspicuous character of this species. The anterior ambulacrum (1 *a*) is concave, and makes an inconsiderable anteal sulcus; there is a single row of pores, flanked by a row of tubercles on each side, with a space between filled by a microscopic granulation; it is abruptly bounded below by the fasciole, and terminates at the disc in a blunt lancet-shaped apex. The antero-lateral ambulacra in the large specimen are $\frac{3}{10}$ths of an inch longer than the posterior pair, and form an angle of 37° with the transverse line through the disc; they are round at the base and blunted at the apex, and the anterior side is more rounded off than the posterior for the reception of the apex of the ambulacrum; in the anterior zone there are twenty, and in the posterior zone twenty-four pairs of holes. The postero-lateral pair describe an angle of 55°; both pairs form concave valleys; the pores in the zones are of the same size, and are pierced so wide apart (1 *c*) that the pores of each pair are nearly as distant from each other as the width of the space which separates the two avenues; in the anterior ambulacral avenues there are twenty in the anterior and twenty-four in the posterior zone; in the posterior pair the numbers are twenty-two before and eighteen behind. The peripetal fasciole (1 *e*) has an unequal width in different parts of its track; it is narrow where it passes over elevations of the test, or is bent into angles, and becomes wider in other parts of its course. The apical disc (1 *a*) is small, heart-shaped and central; the two anterior genital holes are smaller and placed closer together than the posterior pair; the five eye-holes as usual are situated at the summit of the ambulacral apices: the madreporiform tubercle occupies the surface of the posterior triangular genital plate. The anus is a large oblong opening, situated in the upper half of the posterior border, at the distance of $\frac{7}{20}$ths of an inch from the fasciole in the small individual. The base in both specimens is concealed; the tubercles (1 *d*) are small, crenulated and perforated, and nearly of the same size; a few larger ones occupy the sides of the anterior ambulacral sulcus; the sides of the ambulacral areas and as much of their basal portions as is exposed are destitute of tubercles.

Affinities and differences.—*Brissopsis Duciei* is readily distinguished from the other forms of this genus met with in the Maltese beds, by the full development of its ambulacral areas, their straightness, width and depth. The double crescent formed by the ambulacral areas in *B. crescenticus* is a sufficient character by which it may at a glance be distinguished from *B. Duciei*.

Locality and stratigraphical position.—This species was collected from bed No. 1, the Gozo marble, at Malta, where it is rare; the two specimens before us are the only ones we have seen. We dedicate this fine species to the Earl Ducie, whose valuable collection of Maltese fossils has added to our previous knowledge of the palæontology of the island, and whose geological map of Malta so well exhibits the distribution of the various beds with their faults and denudation.

Brissopsis crescenticus (Wright, n. sp.). Pl. VI. fig. 2 *a–c*.

Test oblong, rounded before and truncated behind; flattened on the dorsal surface, and deeply indented by the ambulacral areas; the ambulacrum forms an anteal sulcus; the anterior and posterior ambulacra on each side form two lateral crescents that abut at the longitudinal line; the antero-lateral pair are the longest and widest, they curve forwards and backwards, and the posterior pair curve backwards and forwards; the anterior pair form an angle of 45°, the posterior pair an angle of 65°; the apical disc lies in a depression formed by the confluence of the apices of all the ambulacra; the posterior border is squarely truncated, with the anal opening in its upper angle; the base is convex, with few tubercles and wide naked spaces formed by the basal portions of the ambulacra; the mouth is situated in the anterior third.

Dimensions.—Antero-posterior diameter 1$\frac{6}{10}$ inch, transverse diameter 1$\frac{4}{10}$ inch, height $\frac{8}{10}$ths of an inch.

Description.—The most remarkable feature in this species consists in the mode of arrangement of the ambulacra; the anterior and posterior areas of each side curve in opposite directions and form crescents, the convexities of which are directed towards the middle line of the test, and give value to the name proposed. The antero-lateral pair form an angle of 45°; they are about the same length as the posterior pair, but are a little broader and are more divergent: there are nineteen pairs of holes in the external zone, and fourteen in the inner; the posterior pair are nearly parallel with each other, and have a slight curve forwards to form the posterior horn of the crescent; they are not so much developed as the anterior pair; the external zone of holes contains fifteen pairs, but the inner zone (2 *c*) is imperfectly developed, from their close approximation to those of the opposite area: the apical disc is small; the four genital holes are large, the anterior pair being more closely approximated than the posterior pair; it is situated nearer the anterior than the posterior border and lies in a confluent depression, in which the apices of all the areas freely converge. The single ambulacrum is rather longer, but not so wide as the anterior pair; its lateral row of single holes, with their accompanying tubercles, are small and indistinctly seen, and it forms an inconsiderable anteal sulcus: the posterior border is squarely and obliquely truncated, and in its upper part near the dorsal surface is the large anal opening. the base is rather convex; the sternal portion of the single interambulacrum is slightly prominent, and ornamented with a few rows of rather larger tubercles disposed in zigzag lines · the basal tracks of the ambulacral areas are entirely naked, and where they terminate around the mouth five petaloid poriferous radii are observed. The mouth, of moderate size, is in the anterior third; the peripetal fasciole is narrow and indistinct; the subanal fasciole is much broader, and remote from the anus, but the test is unfortunately broken in this region; the tubercles are nearly all of the same size, but a few larger ones occupy the sides, front, and base.

Affinities and differences.—The flatness of the dorsal surface, the deep depressions made by the petaloid portion of the ambulacral areas, and the double crescent formed by them, readily distinguish *B. crescenticus* from its congeners. So few fossil species of this genus have been figured or described, that we can only compare it with the other forms obtained from the same bed, from both of which it differs in many well-marked characters.

Locality and stratigraphical position.—It was collected from bed No. 4, the calcareous sandstone at Malta, where it is rare.

Genus HEMIASTER (Desor, 1847).

Urchins with a high and much inflated test; ambulacral summit nearly central; the petaloid portions of the ambulacral areas situated in depressions more or less deep; the antero-lateral are in general much longer than the postero-lateral pair; the peripetal fasciole only surrounding in an angular manner the ambulacral star. This genus differs from *Micraster* in all the species having a more inflated body with a peripetal fasciole; from *Brissopsis* in having the postero-lateral ambulacra in general much shorter, and the anterior and posterior pairs more unequal in length, and likewise in having no subanal fasciole. A very few species are found in the tertiaries, the majority belonging to the cretaceous rocks.

Hemiaster Grateloupi (Sismonda sp.).

Syn. *Schizaster Grateloupi*, E. Sismonda, Echin. Foss. Piem. p. 27. tab. 2.

Hemiaster Grateloupi, Desor, Ann. Sc. Nat. tom. viii. p. 19.

Test orbicular, convex above and below, with tumid inflated sides: the single ambulacrum short, shallow and narrow; the antero-laterals long, deep and diverging; angle of inclination 25°; the postero-lateral pair slightly curved inwards; angle of inclination 62°; both pairs lie in deep depressions: the peripetal fasciole broad and undulating: the single interambulacrum forming a dorsal ridge: posterior border abruptly truncated anal opening high near the upper surface: apical disc small and central.

Dimensions.—Antero-posterior diameter $2\frac{8}{10}$ inches, transverse diameter 3 inches, height $1\frac{8}{10}$ inch.

Description.—The orbicular form and inflated sides of this Urchin, with its large, deep, diverging ambulacra, and greater diameter in the transverse than in the longitudinal direction, impart to it an air which widely distinguishes it from other Hemiasters. The single ambulacrum is narrow and shallow, and forms an inconsiderable anteal sulcus, which measures $1\frac{1}{10}$ inch in length from the apex to the fasciole; it has a single row of lateral holes and accompanying tubercles of small size placed near each other within, and the holes only at considerable distances apart without the fasciole. The antero-lateral ambulacra are rather wider and much deeper than the single area; they are $1\frac{2}{10}$ inch in length, and are directed forwards and outwards, forming an angle of 25°; the walls of the depression are formed by the poriferous zones, and the base by the intervening smooth space between them: the postero-lateral ambulacra are directed obliquely backwards and gently curved inwards; they are 1 inch long and form an angle of 62°: the peripetal fasciole closely embraces the base of the areas, and maintains a nearly uniform width throughout its course: the test is very much inflated anteriorly and laterally, and its posterior border is abruptly truncated: the single interambulacrum is elevated into a ridge, which rises between the two posterior ambulacra, at the termination of which the anal opening is situated: the test is covered with small, nearly equal-sized tubercles, which are larger on the fore-part, cheeks, and sides than elsewhere: the apical disc is small, and lies in a depression at the centre of the test, the apices of the interambulacra rising into little eminences around it: the base is entirely concealed by the matrix.

Affinities and differences.—This large species differs so much from its congeners in its breadth, in the depth and divergence of the antero-lateral ambulacra, which are likewise slightly curved forwards, in the length and depth of the posterior pair, which equal the single ambulacrum in length, in the breadth and extent of the peripetal fasciole, and the perpendicular truncature of the posterior border, with the general tumidity of its sides, that it is readily distinguished from them.

Locality and stratigraphical position.—It was collected from bed No. 4, the calcareous sandstone at Malta, and is one of the few tertiary Urchins in our cabinet; it is the only specimen of the species we have seen.

Hemiaster Cotteauii, Wright. Pl. VII. fig. 2 *a–d*.

Test orbicular, globose, much inflated, declining anteriorly, elevated posteriorly, the interambulacrum forming a prominent carina which terminates in a tail-like process above the anus; posterior border obliquely truncated; ambulacral areas deeply sunk; an anteal ambulacrum forms the sulcus in the anterior border; antero-laterals long, and inclined to 45°; postero-laterals one-half the length of the anterior pair, inclined to 57°; apical disc nearly central; peripetal fasciole broad and undulating; anus high under the carinal process; tubercles larger on the sides and base than on the dorsal surface; mouth labiate near the anterior border.

Dimensions.—Antero-posterior diameter $1\frac{10}{20}$ inch, transverse diameter $1\frac{10}{20}$ inch, height $1\frac{11}{20}$ inch.

Description.—This Urchin has a globose form, and is much inflated at the sides; the dorsal surface is convex, and declines much more rapidly from the apical disc to the anterior border, than from the disc to the posterior border. The ambulacral areas (2 *a*) are all deeply sunk; the single ambulacrum is the longest, and forms a considerable anteal sulcus; the antero-lateral pair have a gentle double curve; they are $\frac{7}{10}$ths of an inch in length, and form an angle of 45°. The number of pores (2 *c*) in the avenues is twenty-two pairs in the inner, and twenty-four in the outer zone; the postero-lateral pair are scarcely half the length of the anterior pair; they incline at 57°; their number of pores is ten and twelve pairs. The peripetal fasciole (2 *d*) closely embraces the ambulacral star; a naked track proceeds from the base of the antero-laterals to the mouth, indicating the course of the imperforate portion of the ambulacral areas: the rapid declivity of the anterior part of the test strongly contrasts with the inflated condition of the sides and the elevation of the interambulacrum; from the centre of this area a ridge rises which is produced into a tail-like process, and beneath, the posterior border is scooped out, and truncated obliquely downwards and inwards. The anus is situated high up, immediately beneath the caudal prolongation; the base is convex, and a partially naked space on each side of the sternal portion of the interambulacrum, indicates the track of the basal portions of the posterior ambulacras. The tubercles of the upper surface (2 *b*) are smaller and more closely set together than those on the sides and base, where they are larger, wider apart, and more fully developed. They are perforated and uncrenulated, and surrounded by a circle of small tubercles. *H. Cotteauii* resembles *Spatangus* (*Hemiaster*) *acuminatus*, Goldf., but it is more globose, and its posterior half is neither so elevated, nor yet so wedge-shaped as that species; the single ambulacrum is larger and wider, and the antero-lateral pair are more developed in the German than in the Maltese form; they resemble each other in the interambulacrum in both possessing a tail-like terminal process, and in having the posterior border obliquely scooped out; they are both, likewise, Miocene Urchins, *S acuminatus* being found in that terrain near Cassel and Düsseldorf (Germany), and at Bordeaux and Blaye (France).

Affinities and differences.—The depth and length of the ambulacral areas, with the great declivity of the anterior side of the test, and the post-discal carina, with its caudate-like process, serve to distinguish this species from *H. Scillæ.*

Locality and stratigraphical position.—Collected from bed No. 4, the calcareous sandstone at Malta. We dedicate this species to our friend M. Cotteau, the learned author of 'Études sur les Échinides Fossiles du département de l'Yonne,' who has most generously aided us in our studies, by contributing the types of many of his species to our cabinet for comparative investigations.

Hemiaster Scillæ, Wright, n. sp. Pl. VII. fig. 1 *a–f*.

SYN. *Spatangus crassissimus*, Desmoulins, Études sur les Échinides, p. 394. no. 30.

Echinus, Scilla, Corp. Mar. pl. 10. fig. 4.

Test globular, higher behind than before; ambulacral areas short; single ambulacrum the longest, forming a deep sulcus on the anterior border; antero-laterals wide, diverging at an angle of 44°; postero-laterals not half the length of the anteriors, forming an angle of 56°; both pairs form sulci on the sides of the test: posterior border squarely truncated downwards and outwards: the anus high near the dorsum: base convex: mouth at the anterior third, with a large projecting under lip.

Dimensions.—Antero-posterior diameter $1\frac{9}{20}$ inch, transverse diameter $1\frac{7}{20}$ inch, height $1\frac{4}{20}$ inch.

Description.—Much confusion has arisen as to the identity of this Urchin, occasioned probably by the circumstance of Scilla having figured only the base of the test, and neglected to give either its profile or the dorsal surface. In M. Agassiz's 'Prodromus' it was entered as *Micraster Goldfussii*, but has been omitted from Agassiz and Desor's 'Catalogue raisonné.' M. Desmoulins identifies it with the *Spatangus crassissimus* of Defrance, but on referring to the original description* of that species, we find that Defrance's species came from "la craie chloritée near Havre," and as no species of Urchin known to us passed from the secondary to the tertiary epoch, we must reject the high authority of this most accurate naturalist, and consider the Urchin before us as distinct from *S. crassissimus*. The test inclines to an oblong form (1 *c*); it is higher behind than before, and declines more rapidly from the disc to the anterior border than from the disc to the anus. The ambulacral areas lie in deep depressions; the single ambulacrum (1 *e*) is the longest, and forms an inconsiderable anteal sulcus; the antero-laterals are $\frac{4}{10}$ths of an inch in length, and form an angle of 44°; the number of the pores (1 *f*) in the zones is fifteen and twenty: the postero-laterals are scarcely one-half the length of the antero-laterals; they form an angle of 56°, the number of pores in them is respectively seven and ten: the peripetal fasciole is broad, but feebly marked, and closely embraces the bases of the areas: four sulci (1 *a*), nearly destitute of tubercles, mark the course of the ambulacra from the side of the fasciole to the mouth: the lateral interambulacra are rather inflated, and marked by five or six angular elevations (1 *c*) of the test: the single interambulacrum is elevated on the dorsum (1 *a*), squarely truncated on the posterior border, and convex beneath: the small oval anus is situated very high up, about $\frac{6}{10}$ths of an inch from the disc: the sternal portion of the interambulacrum (1 *b*) is convex and prominent, and is covered with close-set tubercles, arranged in lines, proceeding like radii from a central point of the base: the mouth has a large projecting under-lip. The upper part of the shell is covered with small close-set uncrenulate tubercles (1 *d*), which are larger and irregularly disposed on the front and base: the apical disc is small and nearly central: there are only two genital holes at the apices of the lateral ambulacra: the five eye-holes are very small. Whether one pair of genital holes may be a generic character of *Hemiaster*, we have not the means at present of determining, as most of our specimens of this group have the disc concealed; but about the beautiful *H. Scillæ* now before us there can be no question.

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* Dict. Sc. Nat. tom. 50. p. 96.

Affinities and differences.—The absence of the dorsal carina and caudal process serve to distinguish *H. Scillæ* from *H. Cotteauii*; the latter is likewise a more globose and less elegant form of Urchin, and has the truncature of the posterior border downwards and forwards, whereas in *H. Scillæ* the direction is downwards and backwards.

Locality and stratigraphical position.—Collected from No. 4, the calcareous sandstone at Malta, from whence the original specimen figured by Scilla was obtained. this reason will suffice for the name we have given it.

Genus PERICOSMUS (Agassiz, 1847).

In addition to the general characters of *Hemiaster*, these Urchins have an arched arrangement of the peripetal fasciole and a narrow marginal fasciole, which can be traced round the anterior border, extending along the sides, passing beneath the anus, meeting its fellow from the opposite side, and thereby encircling the test. All the species of this small group have been obtained from strata of the Miocene age.

Pericosmus latus, Desor.

SYN. *Micraster latus*, Agassiz, Cat. Syst. p. 2.
Pericosmus latus, Agassiz and Desor, Cat. raisonné, Ann. Sc. Nat. tom. vi. pl. 16. fig. 1, & tom. viii. p. 19.

Test cordate, broad, convex above, flat below; petaloidal ambulacra straight, deep-sunk and narrow; the posterior nearly as long as the anterior pair; apical discs central; peripetal fasciole closely embracing the ambulacra, with three arches across the single ambulacral depression; marginal fasciole narrow, entirely surrounding the upper part of the border of the test.

Dimensions.—Antero-posterior diameter $2\frac{7}{10}$ inches; transverse diameter $2\frac{7}{10}$ inches; height $1\frac{3}{10}$ inch.

Description.—This rare type of one of the extinct genera of *Spatangidæ* was at first mistaken for a *Micraster* by Agassiz, and entered in his 'Catalogus Systematicus' under the name *Micraster latus*; the peripetal fasciole, however, readily distinguishes it from *Micraster*, and the marginal fasciole from *Hemiaster*. No doubt many mistakes will be committed regarding this Urchin, as these fascioles are exceedingly delicate, and not always preserved: when they are absent, it then greatly resembles a *Micraster*; but when the marginal fasciole is effaced, and the peripetal remains, it then may be mistaken for a *Hemiaster*; fortunately, in one of the specimens before us, the fascioles are both preserved, and their entire course can be traced. The test has a uniformly curved dorsal surface, with a regular cordate form, the base is slightly convex, and the posterior border is truncated. The petaloid portions of the ambulacral areas are straight, and lodged in rather deep depressions, extended obliquely outwards on the middle of the dorsal surface, in the form of a St. Andrew's cross; the single ambulacrum lies in a deep wide depression, and forms a considerable anteal sulcus; at its apical portion only, there are from ten to twelve pairs of ambulacral plates, each perforated in the centre with a single hole; in all the other plates in the area the perforations are obsolete; the antero-lateral ambulacra, $\frac{15}{20}$ths of an inch in length, are nearly straight, having only very slight *f*-shaped flexures, which curve forwards and outwards, making an angle of 35°: the two poriferous zones lie close together, in deep narrow depressions; in each zone there are from twenty-four to twenty-six pairs of holes; the space between the pairs of pores is only a little more than that which separates one row of pores from another, so that the pores lie nearly equidistant from each other in the sunken areas; the postero-lateral ambulacra are $\frac{13}{20}$ths of an inch in length, and are extended backwards and outwards at an angle of 60°; there are from twenty to twenty-two pairs of holes in each zone, the rows of which, like those on the anterior pair, are nearly equidistant. the peripetal fasciole closely surrounds the posterior ambulacral pair, makes two angles on their sides, and crosses to the anterior pair, where it in like manner forms two angles, then sweeps round the base, and passes in a straight line along the anterior side; from it three branches proceed inwards, which arch over the single ambulacrum, describing angles as they advance to meet the branches from the opposite side; the marginal fasciole is a narrow line, which passes above the fold of the border and entirely encircles the test, dipping into the anteal sulcus in its course, but its position in relation to the anus is not clearly shown in either of our specimens. Agassiz figures it as passing under the anus; in his figure the remarkable arches on the anterior part are not drawn: the apical disc is small, and occupies the centre of the test; it has only two genital holes like a *Hemiaster*, and five small ocular holes; the upper surface of the test is covered with small, nearly equal-sized tubercles, those on the anterior side are a little larger; the base is slightly convex, the lateral interambulacra carry large tubercles on their basal plates, and the sternal portion of the interambulacrum is likewise covered with a regular tuberculation; the basal tracks of the posterior ambulacra are smooth between the border and the mouth; the anus is situated high up on the posterior border, and the mouth lies very close to the anteal sulcus.

Affinities and differences.—The central position of the apical disc and the depth and straightness of the ambulacra distinguish this form from *P. excentricus*; the generic affinities of this small genus have been already pointed out. The rarity of *Pericosmus*, and the small number of species and individuals at present known, limit our comparisons to the forms we have cited.

Locality and stratigraphical range.—This is one of the few Urchins found in the clay bed No. 2 at Malta: we have before us a specimen from Balistro, Corsica, from the miocene beds of that island, sent us by M. Michelin of Paris; we consider the peculiar arch-like arrangement of the peripetal fasciole, with the marginal, as good generic characters whereby to form a distinct genus.

Pericosmus excentricus, Wright, n. sp.

Test oblong, highly convex above, slightly so below; apical disc very excentral, near the anterior border; ambulacra in shallow depressions; single ambulacrum slightly grooves the anterior border; antero-laterals nearly transverse; postero-laterals incline at 55°; peripetal fasciole narrow and undulating; marginal fasciole narrow and low on the border; tubercles on the upper surface small, close-set, and nearly all of the same size; a few larger ones on the anterior interambulacra; anus large and situated high on the border; mouth-opening wide in the anterior third, surrounded by five poriferous petaloid zones; sternal portion of the interambulacrum convex, with close-set imbricated tuberculigerous plates; basal portions of the interambulacral pairs with larger tubercles, wider apart, and more irregular than those of the dorsum.

Dimensions.—Antero-posterior diameter 2 inches, transverse diameter $1\frac{8}{10}$ inch, height 1 inch?

Description.—This Urchin is so much crushed that it is impossible to describe its outline. The ambulacral areas form shallow depressions, and the single area slightly grooves the anterior border: the antero-laterals are nearly transverse, their inclination being forwards; they are $\frac{8}{10}$ths of an inch in length: the postero-laterals form an angle of 55°; they are $\frac{5}{10}$ths of an inch long. The crushed state of the test makes it impossible to count accurately the pores, or give the breadth of the areas; the apical disc, with four genital pores, is very small and remarkably excentrical, being very near the anterior border; the peripetal fasciole is narrow, angular and undulating, and instead of surrounding the anterior part of the antero-lateral ambulacra, as in

P. latus, it descends from them and joins the marginal fasciole below their base, so that the anterior sides of the antero-laterals, and the single ambulacrum, want the peripetal fasciole. The specimen before us is so much crushed, that we cannot trace the band continuously all round the test, so as to describe its course with accuracy; it is possible that this species may form the type of a distribution of the fascioles distinct from any that is yet known. We have stated enough to show, that at least in this form there is a considerable deviation from the normal arrangement. The anus is large and oval, and near the dorsum; the mouth is wide and bilabiate, and situated near the border; the sternal portion of the interambulacrum is slightly convex, and thickly covered with an imbricated arrangement on the plates, on each of which a perforated tubercle is raised. The basal portions of the interambulacral pairs are covered with wider-set tubercles of the same size, and the entire upper surface of the test is crowded with small tubercles closely set together, and very uniform in size and arrangement. The mouth is surrounded by five petaloid poriferous ambulacra.

Affinities and differences.—The excentrical position of the disc, with its four genital holes, and the petaloid poriferous ambulacra around the mouth, establish an affinity between this form and *Brissus*. The way in which the peripetal joins the marginal fasciole is similar to what exists in *Schizaster*, whilst the marginal fasciole, entirely encircling the test and passing round beneath the anus, is found only in *Pericosmus*. The excentral position of the apical disc and the shallowness of the ambulacral star form a sufficient diagnosis between this species and *P. latus*.

Locality and stratigraphical position.—Collected from bed No. 1, the Gozo marble at Malta, where it is rare.

[To be continued.]

XVII.—*On the Genera* Pionandra, Cliocarpus *and* Pæcilochroma.

By John Miers, Esq., F.R.S., F.L.S. &c.

Pionandra.

The details of this genus as given in Lond. Journ. Bot. iv. 353, and in Ill. South Amer. Plants, i. 34. pl. 8 & 9, were first drawn up during my stay in the Organ Mountains in 1837, but not published till 1845, and while these were in type, Dr. Sendtner contributed to the Munich flora his genus *Cyphomandra*, identical with the above, so that by a month's priority in publication, the latter name has claimed the preference. I there divided *Pionandra* into two very distinct sections. 1. *Ceratostemon*, which corresponds with Dr. Sendtner's genus, and is distinguished (as both names imply) by their fleshy and curved stamens, and more or less obconical style and stigma, which are often as short and thick as the ovarium itself. 2. *Euthystemon*, comprising those species noted for having the anthers much longer, thinner, and very straight; the style being slender, terete, with a much smaller clavate stigma: the analytical details of the former section are shown in plate 8, and of the second section in plate 9 of the work referred to. M. Dunal in his monograph of the genus, subsequently published in DC. Prodr. xiii. 387, amplifies Dr. Sendtner's *Cyphomandra*, by the introduction of the plants of my section *Euthystemon*, thus increasing the number of species to thirty-four; he classifies those of the former section into five, and of the latter section into three subdivisions, after Dr. Sendtner's plan, according to the relative lengths of the connective and the style. There are many circumstances that make it desirable to keep these two groups quite distinct, having such marked characters; and when Dr. Seemann submitted to my examination the Solanaceous plants of his Panama collection, I ventured, in describing a new species, to suggest to him my views on this head, when he had the kindness to publish them, together with my note on the subject, in his 'Botany of the Herald.' I there proposed to retain in Dr. Sendtner's genus *Cyphomandra*, those species where the anthers are much curved, often rostrate at the apex (as in *C. betacea* and *C. sycocarpa*); the cells being verrucosely crumpled in front, as in many *Melastomaceæ*, and partly imbedded in a fleshy connective, which is dorsally gibbous at the base; the filaments broad and often dilated suddenly, being connected by their bases upon a fleshy ring adnate to the base of the corolla; the style being generally shaped like an inverted cone, more or less thick, and the fruit being a large oval berry, often used for culinary purposes as a substitute for Tomates. They are generally tall shrubs, with large fleshy cordate leaves, emitting a strong, unpleasant smell. This group consists of *Cyphomandra calycina, physaloides, sycocarpa, lobata, diploconos, floribunda, ciliata, fragrans, sciadostylis, premnæfolia, corymbiflora,* and *viridiflora*.

For the second group, I propose to retain my generic name of *Pionandra*, which will include those species formerly designated under the section *Euthystemon*, together with some others that will be indicated below. This genus differs from *Cyphomandra* in its lengthened, straight, erect, and narrower stamens, almost rostrate at the summit below the apical knob, which bursts obliquely in front, forming two bilabiate gaping pores; the pollen-cells also burst below by longitudinal fissures; it has likewise an elongated fusiform hollow style, with its small stigmatic glands wholly included. The latter genus, on the contrary, is remarkable for its thicker and shorter anthers greatly curved upon a fleshy gibbous connective, and for its peculiar style, which is generally short, thick, in the form of an inverted cone, with large distinct stigmatic glands in its mouth: these peculiar features are shown in plate 8 of the 'Illust. South Amer. Plants,' in plates 15, 16 and 17 of Dr. Sendtner in 'Flor. Brasil.' fasc. vi., and in plate 227 of Martius, 'Nov. Gen. et Spec. Bras.' The generic character of the genus *Cyphomandra* with a few omissions will therefore remain as formerly designated by me under *Pionandra* (Illust. South Amer. Plants, i. 34), while that of the latter genus, as now restored and modified, and of which I will add another species with pinnatifid leaves (as in *C. fraxinella*, Sendt.) collected by me in the Organ Mountains, may be summed up as follows:—

Pionandra, nob. (gen. reformatum). *Calyx* 5-partitus, persistens. *Corolla* hypogyna, tubo brevi, limbo amplo 5-partito, laciniis 5 lanceolatis, subtenuibus, æstivatione introflexo-valvatis. *Stamina* 5 æqualia, erecta, stylo circumdantia; *filamenta* brevissima, complanata, in annulum brevem tubo corollæ adnatum imo connata; *antheræ* magnæ, rectæ, superne rostratæ, 2-loculares, loculis elongatis ad connectivum parallele adnatis, rima longitudinali sæpe dehiscentibus, summo globoso-capitatis, hinc antice poris 2 transversim et oblique valvatis, valvibus bilabiatis latissime hiantibus. *Ovarium* oblongum, 2-loculare, placentis carnosis utrinque dissepimento adnatis, multiovulatis. *Stylus* longiusculus, teres, subtenuis, apice longe incrassatus et hinc cavus. *Stigma* in cavo omnino immersum, glandulosum. *Baccà* pulposa, 2-locularis. *Semina* numerosa: cætera ignota.—Suffrutices *in America intertropica indigenæ, ramosissimæ*; folia *petiolata, subgemina, elliptica, integra vel profunde lobata aut pinnatifida*; racemi *extra-axillares*, flores *secundi*, pedicellis *articulatis sæpe deciduis*.

§ 1. *Folia integra.*

1. *Pionandra capsicoides*, nob. Ill. South Amer. Pl. i. 41. tab. 9. Cyphomandra capsicoides, *Dun. in DC. Prodr.* xiii. 396. Solanum capsicoides, *Mart. Bot. Zeit.* i. 78.
2. *P. divaricata*, nob. loc. cit. i. 41. Witheringia divaricata, *Mart. Nov. Gen. Bras.* iii. 75. tab. 228. Cyphomandra divaricata, *Sendt. Flor. Bras.* vi. 118; *Dun. l. c.* 397.
3. *P. laxiflora*, nob. Cyphomandra laxiflora, *Dun. l. c.* 397. Solanum laxiflorum, *Dun. in h. Banks.*
4. *P. oxyphylla*, nob. Cyphomandra oxyphylla, *Dun. l. c.* 396.

5. *P. Hartwegii*, nob. l. c. i. 43. Cyphomandra? Hartwegii, *Dun. l. c.* 401.

6. *P. velutina*, nob. Cyphomandra velutina, *Sendt. Fl. Bras.* vi. 120. tab. 17; *DC. Prodr. l. c.* 398.

7. *P. elliptica*, nob. Cyphomandra elliptica, *Sendt. l. c.* 121; *DC. Prodr. l. c.* 398. Solanum ellipticum, *Vell. Fl. Flum.* ii tab. 100.

8. *P. cylindrica*, nob. Cyphomandra cylindrica, *Sendt. l. c.* 121; *DC. Prodr. l. c.* 399. Solanum cylindricum, *Vell. l. c.* tab. 119.

9. *P. coriacea*, nob. *l. c.* p. 43. Cyphomandra? coriacea, *Dun. in DC. Prodr. l. c.* 401.

10. *P. Cajanumensis*, nob. l. c. Cyphomandra? Cajanumensis, *Dun. in DC. Prodr. l. c.* 401. Solanum Cajanumense, *H. B. K.* iii. 47.

§ 2. *Folia pinnatisecta vel pinnata.*

11. *P. fraxinella*, nob. Cyphomandra fraxinella, *Sendt. l. c.* 122; *DC. Prodr. l. c.* 399. Solanum Martii, *Dun. MSS.*

12. *P. cornigera*, nob. Cyphomandra cornigera, *Dun. l. c.* 401.

13. *P. allophylla*, nob. in Seemann, Bot. Herald, p. 174.

14. *P. pinnata* (n. sp.);—subscandens, glabriuscula, dichotome ramosa, ramulis teretibus, fistulosis, junioribus brevissime pubescentibus; foliis distantibus geminis, altero breviori, impari-pinnatis, petiolo longissimo, imo subglabro, superne tomentoso, foliolis circiter 11, sæpe oppositis, interdum alternis, longe lanceolatis, anguste acuminatis, in texturam tenuibus, supra sparse pilosis, subtus pallidioribus, costa media nervisque hirsutulis, breviter petiolulatis, petiolulo tomentoso, folio terminali alteris longiori et longius petiolulato; racemo longe extra-axillari, elongato, imo nudo, sub 10-flore, floribus alternis, flavis, glabris, subsecundis, pedicellis longiusculis, pilosulis, apice valde incrassatis, imo articulatis, infimis deciduis.—Brasilia (in Montibus Organensibus, Prov. Rio de Janeiro).

I found this plant on the skirts of the extensive forests of the Organ Mountains; the branchlets are green, smooth, round, marked with numerous minute whitish specks, woody but fistular, and somewhat flexuosely geniculated at the nodes, which are 3 or 3½ inches apart. The leaves are about 10 inches long; the petiole diverges nearly at a right angle from the stem, and is bare for the length of 2 inches; the leaflets are generally in opposite pairs, about 1 inch apart, though often alternate; the lowermost are shorter, scarcely more than an inch long, upon tomentose petioles of a line in length; the upper ones are 3 inches long, 7 lines broad, on a petiole of 1½ line; and the terminal one is 8 lines broad and 4 inches long, exclusive of its petiole of half an inch. The raceme issues from the stem upon the same side as the leaf, but at a distance of 2 inches above the axil; it is quite glabrous, about 5 inches long, the lower portion for a length of 3 inches being bare of flowers, but from this point eleven pedicels, each bearing a single flower, spring alternately; they are suddenly thickened below the calyx, are about 8 lines long, and are articulated at their base, the lower ones generally falling away, and leaving cicatrices at the points of their insertion. The calyx is short, with five triangular teeth; the corolla is about 5 lines long, has a short tube scarcely exceeding a line in length, the border being divided into five equal, oblong segments, which are quite smooth, with woolly margins: the stamens are the length of the corolla, the filaments are extremely short, and arise from an adnate 5-toothed ring fixed to the tube; the ovary is short, smooth, not longer than the calyx; the style is slender, somewhat thickened above, and hollow for half its length*.

CLIOCARPUS.

It is now more than five years since I proposed this genus for a Brazilian plant collected in the province of Minas Geräes by my friend the late Mr. Gardner. The generic outline given (*huj. op.* iv. 141) was incomplete, as I had then only seen it in fruit, but I am at length able to add its floral character. The appearance of its saccate ventricose calyx and berried fruit led me to suppose it offered most analogy with *Nicandra*, but this I find is not the case, as it belongs to the true *Solanaceæ*, and to the tribe *Solaneæ*, taking its place between *Pionandra* and *Triguera*. In the structure of its stamens and style there is much resemblance to the former genus: the anthers are erect; the lobes are long, parallel, and contiguously adnate upon a dorsal furrowed connective; they are thin in texture, each being 2-locellate, owing to the existence of a somewhat oblique, slender, complete partition that divides each lobe, which is 2-valvular, and its dehiscence takes place by a longitudinal slit near the outside of the anterior face, caused by the separation of the margins of the valves from the edge of the contracting partition, so that after bursting, each lobe thus appears to be unilocular: this separation is more constant at the summit, where the line of dehiscence crosses the face diagonally towards the middle of the anther, when the broad upper valve is thrown back in an auricular form and into an erect position, while the narrower lower lip is reflected downward, thus showing a broad oblong gap divided by the line of the septum, and forming a continu-

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* A drawing of this plant with its floral analysis will be given in plate 74 of 'Illustr. South Amer. Plants.'

ation of the lateral fissure. each anther is deeply 2-lobed at its base, and is attached at the bottom of its dorsal groove to the apex of a sigmoid-shaped filament, which crosses it abruptly to the front, so that the anther appears fixed astride upon it: the filaments are short and closely surround the ovary, they are compressed, somewhat broad, deeply channelled, being often enlarged in the middle by two auricular erect margins; they are joined together by a narrow, fleshy, annular ring, which is united by its base to the foot of the corolla. The calyx is formed of five lanceolate, acute leaflets distinct nearly to its base, which consists of a small inverted cup, having five saccate cavities alternating with the segments; these segments are at first expanded, but after the fall of the corolla they collapse, increase considerably in size, become yellowish, reticular, and more membranaceous in texture; their margins approximate and turn outwards, thus forming a somewhat pointed, 5-toothed, globosely ventricose pentagonal tube with salient winged angles, which are saccate at their base as above mentioned, thus greatly resembling in shape that of *Nicandra* or *Physalis* in fruit · the segments are densely covered on both sides with glandular, simple, and stellated hairs intermixed. The corolla is nearly the length of the calyx, is cleft almost to the base, where it is briefly tubular; the segments, which scarcely exceed the stamens in length, are expanded, smooth inside, with a keeled medial nervure, and outside are densely tomentose with stellated pubescence. The ovary is conically ovate; the style is slender, erect, fusiform at the apex, and terminated by two minute teeth: the berry is round, about the size or smaller than a common pea, 2-celled, and contains a few large, compressed, reniformly-orbicular seeds. I have ascertained that the *Solanum megalochiton* of Dr. Sendtner, and *S. didymum* of M. Dunal, both belong to this genus; *S. eriocalyx*, from its description, also appears to be congeneric with them, and probably other species of *Solanum*, enumerated by M. Dunal in his monograph, will find a place here. Its generic features may be thus described:—

CLIOCARPUS (char. reform.). *Calyx* profunde 5-partitus, utrinque stellato-tomentosus, rarissime simpliciter pilosus, imo patellaris, circa pedicellum umbraculiformis, et secus sinus 5-saccatus, laciniis expansis, lanceolatis, acutis, in fructu auctus, tunc laciniis erectis (ut in *Nicandram*) marginibus refractis hinc valvatim conniventibus, tubum ventricosum carinato-5-gonum ore 5-dentato fere clauso simulantibus. *Corolla* subrotata, calyce plus minusve æquilonga, 5-fida, laciniis æqualibus, tubo æquilongis vel longioribus, subacutis, apice inflexis, extus tomentosis, intus glabris, nervo medio

prominulo. *Stamina* 5, æqualia, corollæ fere longitudine; *filamenta* brevissima, glabra, ex annulo carnoso imo tubi adnato 5-sinuato orta, valde sigmoidea, complanata, sulcata, apice acuta: *antheræ* magnæ, erectæ, circa stylum conniventes, oblongæ, 2-lobæ, 4-locellatæ, basi breviter bifidæ, ad imum sulci dorsali affixæ, lobis sine connectivo conspicuo parallele adnatis, sulco longitudinali et summo præcipue utrinque rima antica obliqua valvatim late hiantibus, valvula superiori hinc erecta auriculæformi, inferiori fere obsoleta. *Ovarium* glabrum, subrotundum, 2-sulcatum, 2-loculare, ovulis plurimis dissepimento placentifero carnoso utrinque adnatis. *Stylus* simplex, filiformis, staminibus dimidio longior. *Stigma* minutum, brevissime bifidum, dentibus acutis, divaricatis vel adpressis. *Bacca* calyce aucto inclusa, subglobosa, 2-locularis: *semina* pauca, reniformia, compressa, *testa* scrobiculata, *hilo* in sinu laterali; *embryo* teres, in *albumen* carnosum spiraliter arcuatus, *cotyledonibus* semi-teretibus, *radicula* angulo basali spectante, hiloque evitante sub-3-plo brevioribus.—Frutices *Brasilienses, pilis simplicibus* (*plerumque cum stellatis intermixtis*), *dense tomentosi*: folia *alterna, vel sæpe gemina, altero minori, integra, oblonga, acuta, imo obtusa, interdum cordata, breviter petiolata*: flores *extra-axillares, solitarii aut bini, vel in racemo sub-umbellæformi plures aggregati*, pedicellis *longis, filiformibus, fructiferis cernuis.*

1. *Cliocarpus Gardneri*, nob. huj. op. iv. 141; Ill. South Amer. Pl. ii. 35; DC. Prodr. xiii. 675;—fruticosus, subdichotome ramosus, ramis tomentosis; foliis obovatis, e medio acuminatis, basi subrotundatis, sæpe geminis, altero dimidio vel paullo adhuc minori, crassiusculis, supra læte viridibus et pubescentibus, subtus densissime cano- vel flavido-tomentosis, pilis simplicibus cum alteris stipitato-stellatis intermixtis, nervis venisque supra impressis, subtus prominulis et flocculosis, petiolo brevi, crassiusculo: floribus extra-axillaribus, solitariis vel 2–4-fasciculatis, pedunculo obsoleto, pedicellis filiformibus, quam congeneribus longioribus, in fructu deflexis et magis elongatis; bacca pisi majoris magnitudine, nigra, calyce aucto subvesiculari flavo-membranaceo reticulato clausa.—Brasilia, Prov. Minas Geräes.—*v. s. in herb. Hook.* (Arraial das Mercês, *Gardner*, no. 5042).

This plant in fruit has been already described, as above quoted, but I have since found flower-buds, which, though very young, are quite sufficient to identify the same structure as in the two following species; the only difference being, that here the corolla seems to be more deeply cleft than in the others.

2. *Cliocarpus megalochiton.* Solanum megalochiton, *Mart. and Sendtn. Fl. Bras.* vi. 28. tab. 9; *DC. Prodr.* xiii. 124;—dichotome ramosus, ramulis divaricatis, inferne glabris, superne hirsuto-tomentosis; foliis non raro geminis, altero multo minori, ovatis vel ovato-lanceolatis, acuminatis, basi rotundatis, inæquilateris et oblique subcordatis, supra fusco-viridibus, velutinis et sparse villosulis, subtus griseo-tomentosis et pilis stipitato-stellatis densissime tectis, nervis arcuatis venisque superne impressis, subtus valde prominentibus, petiolo brevi tomentoso; racemis paucifloris, terminalibus, dein lateralibus et suboppositifoliis, pedicellis pedunculo brevioribus, creberrime secundis, imo articulatis, inferioribus valde deciduis, superioribus 3–8 pseudo-umbellatis, demum in fructu deflexis, quam præcedenti multo brevioribus; calyce etiam persimile sed paullo minori; corolla intus cærulea? et glabra, extus stellato-tomentosa, filamentis brevibus, medio auriculatis, marginibus inflexis; stylo tenui, staminibus dimidio longiori, apice brevissime divaricato-2-dentato: bacca nigra, pisi minoris magnitudine.—Brasilia, Prov. Rio de Janeiro.—*v. s. in herb. Mus. Brit.* (*Bowie et Cunningham ad* S. João Marcos) *sub nom. Cl. Dunalii* "Solanum melanocarpum et Solanum laxum."—*in herb. Hook.* (*Claussen*).

This species appears to have been collected by Dr. von Martius and by Schott in the Corcovado range, by Llotschy in the Organ Mountains, who considered it to be a *Physalis* on account of its ventricose calyx, and was also found by Sello in other parts of the same province. It is readily distinguished from the former species by its more lax habit, more divaricate branches, and its different inflorescence. Its leaves are from 2 to 3 inches long, 1 to 1½ inch broad, on a petiole of 2 lines. The peduncle of the raceme is from 6 to 9 lines long, sometimes even shorter; its pedicels 4 to 6 lines in length when in flower, and 9 lines in fruit: the flower expanded is about 8 lines in diameter; the calyx when collapsed in fruit is about 5 lines in diameter, and when its segments are expanded, according to Dr. Sendtner, 12 to 15 lines across: the berry when ripe is smooth and black, 4 lines in diameter, and contains about sixteen seeds. M. Dunal describes two varieties in the 'Prodromus,' citing as his authority, plants observed by him in the British Museum; but I find there only a single specimen with two separate tickets attached to it, bearing his autograph names of *Solanum melanocarpum* and *Solanum laxum,* from which we may infer that his notes have been taken at different times, and after a lapse of many years concluded to be those of two separate plants*.

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* The floral details of this plant are given in the drawing of the preceding species in plate 44, 'Illustr. South Amer. Plants.'

3. *Cliocarpus didymus*. Solanum didymum, *Dun. in DC. Prodr.* xiii. 125 (*olim S. divaricatum*, Dun. MSS.). Solanum gemellum, *Mart. & Sendtn. Flor. Bras.* vi. 28;—valde dichotomoramosus, ramulis divaricatis, teretibus, primum ochraceo- et fusco-tomentosis, dein glabris; foliis supremis geminis, altero ter quater ve minori, brevissime petiolatis, ovatis vel ovato-lanceolatis, apice acuminatis, basi inæqualiter rotundatis, vix cordatis, supra velutinis, subtus molliter albido- ochraceo- vel ferrugineo-stellato-tomentosis, nervis arcuatis, sub 5-jugis, venisque superne impressis, subtus prominentibus et flocculoso-tomentosis; floribus cymoso-racemosis, confertis, paucis, dense stellato-tomentosis, terminalibus dein lateralibus et oppositifoliis, pedicellis pedunculo brevissimo duplo longioribus, quam præcedentibus brevioribus; calycis laciniis oblongis, subito acutis; corolla calyce paullulo longiori, semi-5-fida, campanulato-rotata, intus glabra; staminibus corolla dimidio brevioribus, hiatibus apicalibus latis, cum rimis longitudinalibus continuis; ovario brevi, stylo tenui, demum longe exserto, stigmate fere obsoleto; bacca subovali, piso minori, lævi.—Brasilia, in provinciis interioribus.—*v. s. in herb. Mus. Brit.* (*Bowie & Cunningham*) Prov. S. Paulo *sub nom. Cl. Dunalii* " Solanum divaricatum."—*in herb. Hook.* (*Claussen*) Cachoeira do Campo Prov. Minas Geräes.

This species was found also by Sello in the province of San Paulo. M. Dunal describes the varieties of *glabrum* and *tomentosum*, but they seem to be different states of the same plant varying with its age. Its leaves are from 2 to 4 inches in length, 8 to 13 lines in breadth, upon a petiole 2 to 4 lines long: the peduncle of the inflorescence is not more than 4 to 6 lines in length, often much shorter; the pedicels being 2 to 4 lines long, and when in fruit 6 to 8 lines in length; the corolla expanded is 8 lines in diameter; the stamens are 2 lines long; the enlarged calyx enveloping the fruit forms a sphere of 8 lines in diameter.

4. *Cliocarpus? eriocalyx*. Solanum eriocalyx, *Dun. in DC. Prodr.* xiii. 124;—ramis divaricatis, flexuosis, piloso-scabriusculis, ramulis foliis utrinque, pedunculo, pedicellis, calyce quaquaversus, corollaque extus pilis longis simplicibus hirsutis, foliis sæpe geminis, altero minori, ovato-oblongis, acuminatis, basi inæqualibus frequenter auriculatis, ciliatis, flavicantibus, costa media nervisque prominulis, petiolatis, folio altero ter quaterve minori, ovato-rotundato, subsessili; racemis brevibus, hirsutis, sub-oppositifoliis, 7–8-floris, pedicellis elongatis, filiformibus, confertis, sub-umbellatis: calyce rufescente, pilis sordide albis hirsutis, laciniis ovato-oblongis, apice subnudis; corolla semi-5-fida, laciniis lanceolatis, acutis; antheris gracilibus, linea-

ribus, apice præcipue auriculato-hiantibus; stylo filiformi; bacca subglobosa, calyce amplo obvoluta.—Brasilia (Lund).

This plant, from the above details founded on the description of M. Dunal, appears to conform closely with the three preceding species in all respects, except in the mention of stellated pubescence intermixed with simple hairs: as it is arranged by M. Dunal between the two last-described species, it may be safely inferred to be congeneric with them. The leaves are said to be 2–2½ inches long, 10 to 13 lines broad, on a petiole 1 or 2 lines in length. the twin leaf is 7 lines long and 6 lines broad. the peduncle is 2 or 3 lines long, with seven or eight almost umbellate slender pedicels 7 to 9 lines long: the calyx is 4 or 5 lines in diameter.

PŒCILOCHROMA.

As it is always better to retract an error when its ill tendency becomes apparent, I do not hesitate to do so in the following cases. Not long since (*huj. op.* xi. 92 & 93), bearing in view the fact I had discovered, that the typical species of *Witheringia*, L'Hér., belonged to the genus *Sarracha* of the 'Flora Peruviana,' and under the influence of too much eagerness to follow the strict rule of science, I recommended that all the plants of this latter genus should be called *Witheringia*, as a title of older date; also that the name of *Pœcilochroma* should be suppressed, and its different species referred to *Sarracha*. Several of my botanical friends have pointed out to me the great inconvenience of changing the names of plants so numerous and so long known and cultivated in our gardens, adding that it is always desirable on the score of expediency to forego a rigid law, where the adoption of it is attended with so much inconvenience, by the multiplication of puzzling synonyms. Fully impressed with the force of this argument, I propose to adhere to my original plan of retaining the name of *Witheringia*, as defined by Von Martius, for the plants enumerated *huj. op.* iii. 141, and preserving that of *Pœcilochroma* as before established, while *Sarracha* will remain attached to those plants by which they have been extensively known for so many years. The synonyms recommended (*huj. op.* xi. p. 92 & 93) should consequently be expunged, when the species will stand thus:—

	Ill. So Am Pl	DC Prodr.
1. **Sarracha solanacea**, *nob.* (Witheringia id.) ...	ii 21	xiii. 402
2. —— **villosa**, *Don* .... „	ii. 16	xiii. 430
3. —— **contorta**, *R. & P.* ... „	ii. 16	xiii. 430
4. —— **Zuccagniana**, *R. & S.*	ii. 16	xiii. 430
5. —— **biflora**, *R. & P.* ...	ii. 16	xiii. 431
6. —— **procumbens**, *R. & P.*	ii. 16	xiii. 431
7. —— **umbellata**, *G. Don* ...	ii. 16	xiii. 431
8. —— **alata**, *Dun.* .... „		xiii. 431

		Ill. So. Am. Pl.	DC. Prodr.
9.	**Sarracha jaltomata**, *Schl.* (Witheringia id.)...	ii. 16	xiii. 432
10.	—— **allogona**, *Schl.* ...... „	ii. 16	xiii. 432
11.	—— **dentata**, *R. & P.*....... „	ii. 16	xiii. 432
12.	—— **viscosa**, *Schr.* .... „	ii. 16	xiii. 433
13.	—— **ciliata**, *nob* .... „	ii. 16	xiii. 683
14.	—— **propinqua**, *nob.* ...... „	ii 17	xiii. 683
15.	—— **diffusa**, *nob*....... .... „	ii 17	xiii 683
16.	—— **laxa**, *nob*.. .... „	ii 18	xiii. 683
17.	—— **auriculata**, *nob.* ...... „	ii 18	xiii. 683
18.	—— **conspersa**, *nob* ...... „	ii. 19	xiii. 684
19.	—— **glabrata**, *nob* .... „	ii 19	xiii. 684
20.	—— **acutifolia**, *nob.* ...... „	ii. 19	xiii. 684
21	—— **vestita**, *nob* .... „	ii 20	xiii. 684
22.	—— **glandulosa**, *nob.* ...... „	ii 20	xiii. 684
23.	—— **Miersii**, *Dun.* (S. diffusa, *nob. bis*) ...	ii. 22	xiii 684

		Ill. So. Am. Pl.	DC. Prodr.
1.	**Pœcilochroma punctatum**, *nob.*	153	xiii 495
2.	—— **frondosum**, *nob.*	154	xiii 495
3.	—— **guttatum**, *nob.*	155	xiii. 495
4.	—— **maculatum**, *nob.* ..	156	xiii. 495
5.	—— **Lobbianum**, *nob.*	157	xiii. 496
6.	—— **Lindenianum**, *nob.*	157	xiii 496
7.	—— **Quitoense**, *nob* .	157	xiii 496
8.	—— **Boisseri**, *Dun.*		xiii. 495
9.	—— **Funkiana**, *Dun*		xiii 687
10.	—— **Sellowiana**, *nob.* (Witheringia id., *Sendt.*)		iii. 403

		Ill. So. Am. Pl.		DC Prodr.
1.	**Witheringia picta**, *Mart.* ..	ii. 5	(Athenæa id *Sendt.*) .	xiii. 458
2.	—— **pogogena**, *nob*	ii. 5		xiii. 459
3.	—— **micrantha**, *nob.*	ii. 5		xiii 460
4.	—— **Schottiana**, *nob.*	ii. 5		xiii. 461
5.	—— **Pohliana**, *nob.*	ii. 5		xiii 461
6.	—— **Martiana**, *nob.*	ii. 6		xiii. 462
7.	—— **hirsuta**, *nob.*	ii. 6		xiii. 463
8.	—— **anonacea**, *nob.*	ii. 6		xiii. 463

The seven new species of *Witheringia* from Chile enumerated by Remy (Walp. Ann. iii. 160) do not appear to belong to this genus: the four last seem related to *Solanum tuberiferum*, Dun. (olim *Witheringia montana*, Dun., *Solanum montanum*, R. & P.), but the floral characters there given are not sufficient to determine their true place.

XVIII.—*On the Discovery of Viviparous Fish in Louisiana**.

By B. Dowler, M.D.

In the month of October 1854, through the politeness of J. C. B. Harvey, M.D., of Tchoupitoulas Street, I received a small osseous fish, caught in the New Orleans Canal, which connects the city with Lake Pontchartrain. This fish had been placed in a basket containing crabs, one of which wounded it slightly in the abdomen near the cloaca, thereby exposing several fœtal fish enveloped in a delicate membrane. The parent fish, which had been rudely thrust into a narrow-mouthed phial of spirits, retains, after immersion for two weeks, the original *rigor mortis*, and the same remark applies to the fœtuses, though they have been soaked in water: some of them have been forcibly straightened. On the 17th of October, in the presence of, and assisted by Drs. J. Hale and M. M. Dowler, I enlarged the wound and proceeded to dissect a somewhat globular mass of fœtuses bounded by the intestines before, and separated from them by an indescribably thin, diaphanous membrane; this mass was further bounded above by the spine and ribs, below and behind by the posterior inferior abdominal walls, bulging backward of the anal orifice and fin. The exterior envelope of this oblong globe consisted of a very thin, pellucid, extremely delicate and apparently laminated and flocculent membrane, like the amnion of the human embryo in the early state; it did not form a simple sac, but consisted of many duplications, like the arachnoidal reflections among the sinuosities and convolutions of the human brain, sending its prolongations as the hyaloid membrane does through the vitreous mass of the eye.

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* From Silliman's Journal for Jan. 1855.

This uterine membrane (ovisac it cannot be termed) contained twenty-two fishes. It is probable that the inner surface of the uterine membrane sent forth a still more delicate membrane which enveloped each fish after the manner that the peritoneum envelopes the abdominal viscera; but the parent fish, and still more its enclosed organs, were too minute to admit of full demonstration during a necessarily hurried examination; moreover, the wish not to mutilate the parent fish very much, prevented a fuller dissection of the fœtal mass *in situ*.

Each fœtal fish was doubled laterally, sometimes to the right, sometimes to the left, into a globular form: the caudal fin, which is inclined to the lancet shape, though blunter, overlapped one eye and one side of the mouth: each fish *in situ*, and even after forcible extraction from its bed, was enfolded in a sac; some were drawn out united by pedicles to a common stem, somewhat like an umbilical cord.

These fœtal fishes presented a perfect example of close packing. A perceptible force was required to dislodge them from their beds. The concavity left by their extraction appeared to be lined with a smooth, black, peritoneal membrane.

The intestines, which were very minute, were crowded forward by the rounded mass of fœtuses which occupied the greater portion of the abdominal cavity. No ova were discovered.

Without attempting fully to describe even the dermal skeleton, I may observe, that this tiny fish is a most symmetrical one. Its minuteness may be imagined when I state, that after the removal of the enclosed fœtuses it weighed only seven grains, though not disemboweled. Thorough desiccation would probably reduce its weight one-half or more. The fish exposed for two hours in the shade on a damp day, was but slightly desiccated. It was weighed by Mr. Macpherson, apothecary, in my presence; but fearing a mistake, I had it weighed a second time, with the same result. If each fœtus weighed but one grain, the aggregate would be more than three times that of the mother.

Measurements in inches:—Length, including the caudal fin, 2 inches; greatest circumference, 1¾, width vertically, ½; length of thoracic fin, ¼: the caudal fin does not expand from its base or proximal end, but terminates ovally; its length, ½; the anal, but little expanded, ¼; the ventral is too minute for convenient measurement, being almost invisible without a lens; the dorsal, which is single, has but a slight vertical width, arising from a base ¼ of an inch, nearly opposite, though a little forward of the anal.

The teeth are advanced, nearly ranging with the lips, being very numerous, close and small, though scarcely discernible without a magnifying glass. Lips thin, the under one slightly projecting; angles of the mouth not depressed. Eyes medium size. Head flattened at the frontal bone. Operculum much expanded. The branchiæ largely developed in three great arches, densely fringed with thick tufts, the outer and inner rows inclining to the central, having also one, perhaps more rows behind, which are shorter.

The predominant hue of this fish is a tawny or fawn colour; the opercula silvery; head metallic gray; muzzle blackish, slightly projecting.

There are six rows of rather quadrangular black spots, more particularly marked in the posterior half of the body, averaging twenty-five spots for each row. These black spots, resting on a tawny ground, leaving intervals something larger than themselves, give a picturesque appearance, forming stripes of alternating hues, the three upper of which slightly curve corresponding to the arching back; but each succeeding one becomes straighter, the fourth and fifth being nearly straight; the sixth, or lower row, follows the abdominal curve, and disappears at the anal fin; the other five rows gradually converge without coalescing at the origin of the caudal fin. At the origin of this fin the spots are displaced out of line. By this arrangement the six rows of alternating black and tawny leave in the longitudinal direction six other continuous tawny stripes, all of which except the two interrupted ones, lost at the anal fin, converge without mingling in the tail, all being about equal in length. The colours fade somewhat into a grayish-yellow round the thoracic fins, which are nearly central between the dorsum and abdomen, being on a level with the eyes, and about one line from the opercula.

There are six or seven rows of scales. The spinous rays of the fins are, about twenty-five caudal, twelve anal, fifteen dorsal, ten thoracic.

The fœtuses are half an inch long, all alike, exactly resembling the maternal form and proportion, with the following slight exceptions: namely, their bodies are more slender and compressed laterally; their heads are comparatively larger, and their eyes more prominent; their colours are less variegated, and paler. A still greater difference appears about the middle of the abdomen, where there is attached to each fœtus a whitish, faintly yellowish, placenta-like irregularly formed mass of considerable size, having a broad base, being apparently implanted in or blended with the abdominal integument, possessing considerable strength, and constituting what may be termed the umbilical prominence; perhaps it may turn out upon further examination that this mass may not be placental, but an adherent mesenteric mass of convoluted membrane.

These fœtal fishes were probably sufficiently developed at the time of the parent's death to live independent of the mother.

The remarks of Dr. Dowler upon a viviparous fish of Louisiana, contained in the above notice, add a few points to the unpublished facts connected with the history of that family. The fish itself is not new; it has already been described and figured in 1821 by Lesueur, in the 2nd volume of the Journal of the Academy of Natural Sciences in Philadelphia, under the name of *Pœcilia multilineata.* It belongs to my family of *Cyprinodonts**. I have had ample opportunity of observing large numbers of this fish during my stay in the South, in the spring of 1853, in Mobile and in New Orleans, where it is found everywhere in the lagoons in the immediate vicinity of these two cities, and not only of ascertaining that they are viviparous, but also of tracing the whole development of the embryo from the first stages of the segmentation of the yolk to the hatching of the young, which were freed from the abdominal pouch of the mother in the month of April. The date of the observations of Dr. Dowler seems to show that they breed twice a-year. I should have hastened to publish my investigations, had not Duvernoy already published a very full account of the later period of the embryonic growth of another species of this genus,

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[illegible]siz's Recherches sur les Poissons fossiles, vol. v. pt. 2. p. 47.

the *Pœcilia surinamensis*, Val., in the 'Annales des Sciences Naturelles,' 3rd series, vol. i. p. 313. plate 17, to which my own observations, except with reference to the earlier changes of the embryo, will add comparatively little, when published. That the fish observed by Dr. Dowler is the same as that I had an opportunity of investigating, his description shows very plainly. There is only one fact to which I would again call attention, though I have already noticed it before, that the genus *Mollienesia* of Lesueur is founded upon the male of the same species he has described as *Pœcilia multilineata.* There cannot be the slightest doubt about it, for I have repeatedly seen them copulate; and among a large number of specimens examined, all those that answer to the description of *Mollienesia latipinna* are males, and all those corresponding to the description of *Pœcilia multilineata* are females. There are several species of this family much smaller than this *Pœcilia multilineata*; indeed, it contains the smallest representatives of the great type of Vertebrates. My *Heterandria formosa*, for instance, when full-grown, is not quite an inch long, and does not weigh more than five grains. An adult male weighed 33½ milligrammes.

L. Agassiz.

Cambridge, U. S. Aug. 22, 1854.

XIX.—*On the anomalous Oyster-Shell described in the 'Annals' for February.* By Dr. J. E. Gray.

To the Editors of the Annals of Natural History.

Gentlemen,

I have received an explanation of the anomalous Oyster-shell described by me in your last Number, from my friend Dr. Gray, and as it appears to me wholly satisfactory, I forward his note, for the benefit of those of your readers who, like myself, may not have been aware that similar monstrosities, as I am informed by him, are by no means of unfrequent occurrence.

Your obedient servant,
George Busk.

"My dear Busk,

"I have little doubt the shell you described in the last Number of the 'Annals' is that of an Oyster (*Ostrea edulis*), growing on the *inside* of a valve of *Pholas candida.* The inside of the shell of that species has markings corresponding to the tubercles and lines on the outer surface, and in the specimen figured these markings are impressed on the outer surface of the Oyster-shell. It further appears, that the shell of the *Pholas* must have been that of a dead specimen, since it had growing upon it a *Mem-*

branipora, or *Flustra*, which is impressed on the outer surface of the Oyster; and thence a further proof is afforded that the *Pholas* was external, and served as a mould to the Oyster-shell, and is not enclosed within its substance.

"Yours truly,
"J. E. Gray."

Greenwich, Feb. 17, 1855.

XX.—*On* Actinophrys Sol. By E. Claparede*.

[With a Plate.]

It can scarcely be doubted that nearly all true Infusoria, that is to say, all animal Infusoria, possess at least an indication of a circulation, by which expression we would refer to the so-called *contractile vesicles*, without however at present deciding as to the kind of circulation, or whether it be a circulation of blood or water. Nevertheless this structure has hitherto remained undiscovered in many Infusoria, apparently of animal nature; in one very pretty animalcule, the *Actinophrys Sol*, especially, it has been overlooked by nearly all observers. As, however, I recently met unexpectedly with a considerable number of this *Actinophrys* in a bottle where I had not previously observed them, I was struck by a peculiar organ possessed by all the individuals, which puzzled me at first, but soon showed itself to be undoubtedly a contractile vesicle placed in a very remarkable position.

Ehrenberg, in describing *Actinophrys Sol* in his great work on the Infusoria, of course endeavoured to discover in it the stomach cells, mouth and anus required by his theory. Accordingly, as might be expected, *Actinophrys* was said to capture animalcules and microscopic plants by means of a proboscis, digest them in connected stomachal cells, and get rid of the indigestible portions through an anal opening. Later observers (Dujardin, Kölliker, &c.) could find nothing of this, and affirmed either that the animal did not eat, or that it converted any part of its body at pleasure into a mouth or an anus. Kölliker, in particular, conjectured that Ehrenberg had seen a process, which would gradually have formed a tentacle, and had taken it for a protrusible proboscis. Nevertheless Ehrenberg's assertions as regards the mouth are by no means groundless; his observations are perfectly correct, but his explanation of them quite inadmissible, as will be seen from what follows.

When seen from above (Pl. VIII. fig. 1), *Actinophrys Sol* appears circular, but its general form is spheroidal, with a great number of radiating processes, which are sometimes very long. No distinct nucleus is to be recognized. What Kölliker describes under this name scarcely deserves to be so called, for this supposed nucleus passes gradually into the general substance of the body, as indeed Kölliker himself perceived. Apparently the substance of the body becomes condensed by degrees towards the centre or in the opposite direction, producing a difference in appearance between the central and peripheral parts. The names "inner layer" and "outer" or "cortical layer" are therefore preferable. From time to time a globular prominence rises slowly and gradually from a particular point on the surface of the animal (fig. 1 *o*); this increases more or less in different cases, sometimes, especially in small individuals, attaining nearly a third of the size of the entire body, but generally reaching only $\frac{1}{8}$th or $\frac{1}{10}$th of that size. The margin of this projection is always well defined, much more so than the other parts of the body, especially when it has attained its greatest evolution. At this moment it contracts suddenly and disappears entirely, so that a flattening of the outline is often to be observed at the point previously occupied by this remarkable elevation; the margin soon becomes rounded again, the globular projection gradually rises, attains its previous highest development, and then suddenly disappears again.

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* Abridged from Müller's Archiv for December 1854.

At first I felt inclined to adopt Ehrenberg's statements as to the presence of a mouth in *Actinophrys*, as the description of the so-called proboscis agreed exactly with my own observations, especially as Kölliker had entirely overlooked this peculiar phænomenon, and his descriptions of the mode in which the animal eats did not appear to me to be quite clear. In fact this regular protrusion and contraction of the proboscis, as Ehrenberg called it, rendered the admission of foreign bodies into the substance of the *Actinophrys* far more intelligible than the mode of inception supposed by Kolliker, by the mere pressure of the processes*. But if this organ were not a proboscis in Ehrenberg's sense, nothing appeared to me more natural than to consider it as a contractile vesicle, on account of its regular contractions, especially as this view was supported by Prof. J. Müller.

This opinion, however, is not new; it has already been put forward in Von Siebold's 'Comparative Anatomy,' but has not been referred to by the generality of observers. Siebold says, "In this respect (the contractile vesicle), *Actinophrys Sol* is very remarkable; its contractile vesicles are situated so close under the general integument, that the fluid flowing to them from the parenchyma dilates the integument into the form of a pellucid bladder; the latter, however, still retains sufficient elasticity to drive the nutritive fluid again into the parenchyma by its contraction." There is, however, no general integument in this animalcule, so that the nutritive fluid cannot be driven back into the parenchyma by its contraction. In his classification Siebold placed *Actinophrys* amongst his *Stomatoda*, or Infusoria with a distinct mouth and œsophagus, and close to *Prorodon* and *Leucophrys* amongst the true Ciliata, which are evidently far higher in organization, and some of which possess a well-developed dental apparatus, in addition to a ciliated mouth and œsophagus, whilst there can be no doubt that the natural position of *Actinophrys* in the system is near *Amœba* and *Arcella*, amongst the Rhizopoda.

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* Kölliker, Ueber *Actinophrys Sol*, Zeitschr. fur Wiss. Zool. 1849.

Siebold ascribes two contractile vesicles to *Actinophrys*, whilst I have never seen more than one. Several vesicular elevations often occur on the margin, but only one of these is contractile. I have, however, observed two contractile vesicles in several individuals (fig. 2), but in these cases the form always gave rise to a suspicion of fission or of an amalgamation of two individuals (*Act. difformis*, Ehr.). The presence of a single contractile vesicle does not, however, appear to be universal amongst the Rhizopoda: I have observed two in *Arcella vulgaris*. Stein* also has recently called attention to the vesicles in question, and also mentions the existence of two, which furnishes an additional support to Siebold's assertion. It is still a question, however, whether he saw them in undoubtedly *simple* individuals.

It is surprising that Kölliker, who was acquainted with Siebold's observations, should have characterized them as incorrect, and as arising from an illusion According to him, Siebold had mistaken accidental expansions and contractions of the substance enclosing the vacuoles, in which the latter were persistent, for phænomena indicating the existence of contractile reservoirs. This, however, is not the case; the size, the unchanging position, and the regular expansion and contraction of this organ, resembling the systole and diastole of a heart, will prevent its being confounded with a vacuole. That Kölliker should have overlooked it is particularly unintelligible, as the phænomenon is immediately presented by nine out of ten specimens of *Actinophrys*. I have often admired this charming spectacle for hours, without observing the least irregularity.

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Before quitting the consideration of the contractile vesicle, we may glance at the part it plays in the œconomy of the animal. Ehrenberg's hypothesis of a seminal vesicle emptying itself regularly every minute, or even more frequently in most Infusoria, is quite indefensible. There remain, therefore, only two different views as to the nature of the contractile vesicles,—they are either true hearts, like those possessed by most animals furnished with blood-vessels, or heart-like organs allied to the Polian vesicles of the Echinodermata, or to the pulsating dilatations of the aquiferous vessels of the Cestode and Trematode worms, and of the Rotifera. O. Schmidt has maintained the latter view, and the great similarity of the contractile vesicles of the Infusoria and Rotifera is certainly in its favour. Nevertheless we cannot adopt this opinion, as these contractile vesicles are deficient in the leading characteristics of an aquiferous system, namely the existence of ciliary movement in its smaller branches, and especially of an immediate connexion with the surrounding medium. We cannot indeed deny the existence of the former of these characters, as no vessels have hitherto been discovered amongst the Infusoria, but the other indispensable condition is certainly wanting. It might be supposed that the openings of the aquiferous system, if present, had escaped us from their small size, but such a supposition is rendered exceedingly improbable by the position of the contractile vesicle in *Actinophrys*. If an opening existed at that point, it must be visible, or at all events currents would be observed in the water during the reception and expulsion of fluid. As this is not the case, the contractile vesicles of the Infusoria can only be compared with the heart-like organs of the sanguiferous systems of other animals.

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* Die Infusionsthiere, auf ihre Entwickelung untersucht von Stein. Leipzig, 1854.

Ehrenberg can never have seen the animal feeding, otherwise he would have recognized the true destination of the so-called proboscis, for the reception of food certainly takes place at quite another part of the body. Stein has also, as already stated, mentioned the contractile vesicle of *Actinophrys*, but he rejects Siebold's explanation, merely because "he is acquainted with no infusorial animal in which the contractile space can be protruded externally." He recurs therefore to an opinion not far removed from Ehrenberg's, and endeavours to explain the reception of food by the action of this organ. Thus, according to Stein, the prey when captured by the tentacles is brought in contact with one of the protruded vesicles, to which it adheres; this then suddenly disappears into the cortical layer, drawing the prey with it, which at first lies in a funnel-shaped pit formed by the contraction of the vesicle, but is afterwards drawn into the interior of the cortical layer by the rolling over of the margins of the pit, and thence passes to the medullary layer. Stein considers that Kölliker's observations are in accordance with this, as he also first saw the food lying in a pit on the surface of the cortical layer, and supposes that Kölliker has overlooked the previous moment in which the place of the pit is occupied by a cæcal prominence. Kölliker's statement that any portion of the surface may be employed indifferently as mouth or anus, is got over by the supposition that although in general only two opposite vesicular spaces in the cortical layer are protrusible, under certain circumstances any other vesicular space at the surface of the body may be more or less distended so as to be brought into contact with any object that may be seized by the tentacles. We shall, however, satisfactorily prove that this view is untenable, and that the mode in which the reception of nourishment takes place is not reconcilable with any such office of the protrusible process. We have been fortunate enough repeatedly to witness the feeding of *Actinophrys*, a phænomenon which has escaped Stein, in spite of his careful observations, and can therefore assert that the reception of food is never effected by means of the expansion and contraction of the vesicle. The contractile vesicles (*vesicular spaces* of Stein) cannot be employed for any other purpose, than, like a heart, to drive the nutritive fluid into the substance of the body. Stein also wishes to prove that the movements of the animal are produced by these vesicles; this is also untenable.

Kölliker, on the contrary, is perfectly right in stating that "*Actinophrys* can convert any part of its body at pleasure into a mouth, and employ it for the reception of food," and that it can "also evacuate the indigestible portions at any point." Nevertheless I cannot entirely agree with his description of the process of ingestion. According to his account, a pit forms itself for the food in the substance of the body, and after the entrance of the object, the margins of the pit approach and unite. It is not, however, the food that penetrates into the substance of the body,—it is rather the latter that approaches and embraces the food. When an animal or plant comes accidentally within reach of the tentacles of an *Actinophrys*, it remains adhering to the sticky substance of which these appear to be composed. The *Actinophrys* then slowly contracts the tentacle or tentacles with which the prey is in contact, and before the latter has touched the surface of the body, it is seen to be enveloped in a kind of mucus. This mucus is completely undistinguishable from the parenchyma of the *Actinophrys*; it appears as though the substance of which it is composed had suddenly drawn itself over the captured object. The elevation thus produced then slowly flattens, and by this means the food is gradually drawn into the body (fig. 8). *Astasiæ*, which I frequently saw sucked in by *Actinophrys* in this way, continued to move for a little time, endeavouring to break through the substance that enveloped them; their movements, however, soon ceased; they became converted into a globular mass, which circulated very slowly through the parenchyma with the so-called vacuoles. The particle of food always lies in a cavity filled with fluid (*vacuole* of Dujardin), but it could not be determined with certainty whether this fluid was a product of digestion, a secretion assisting in that function, or merely water sucked in with the food. As, however, the fluid always exhibited the same pale reddish colour as the contents of the contractile vesicle, indicating different refractive powers from those of water, the last supposition could not be supported. However this may be, the process of digestion always requires a considerable time. I once followed the changes of a *Chlamidomonas* which had been swallowed by an *Actinophrys*; small as the object was, three hours scarcely sufficed for its conversion into an unrecognizable gelatinous mass.

This mode of feeding is exceedingly remarkable, and it must be admitted, not very easy of comprehension. At first I thought that the substance which so suddenly enveloped the object to be swallowed, was produced by the mere bending, expansion and fusion of the tentacles. I could not, however, retain this opinion; an extension of a mucous substance, apparently the parenchyma, really takes place from the side of the *Actinophrys*, and this is afterwards drawn in with the prey. This expansion sometimes takes place very slowly. A thick, regularly lobed mass is seen to embrace the object (fig. 4 *a*), and I have once observed this extension without the presence of any prey (fig. 4 *b*). I can only compare this process with what takes place in *Amœba*. Dujardin indeed asserts that the *Amœbæ* are nourished by the mere imbibition of fluid, and that the particles of food found in them come there by accident. This statement, however, is not in accordance with facts. The *Amœbæ* really feed in a very remarkable manner; they glide slowly along, and draw themselves like a veil over the objects to be swallowed; one would suppose that the objects still lay beneath them, but they are already enclosed within the body. We may observe in passing that it appears almost absurd to attempt the distinction of species amongst the *Amœbæ* until we know something more of their intimate organization. Thus Ehrenberg's *A. radiosa* is characterized by the regularity of its processes and its generally stellate form; but when the creature creeps and feeds, it slowly expands, and its characteristic form disappears; it *flows* along like a cloudy veil or a drop of oil, and *A. radiosa*, Ehr. has become converted into *A. diffluens*, Ehr. *Arcella vulgaris* undergoes an exactly similar change, under the same circumstances.

The mode of feeding of *Amœba* and that of *Actinophrys* are evidently two allied phænomena. This analogy has hitherto escaped notice, except by Kölliker, principally on account of the determinate form of *Actinophrys*, which contrasts strongly with the extremely changeable and almost formless *Amœbæ*. I have, however, frequently convinced myself that *Actinophrys* partakes of this wonderful alterability of form. They may be found with very long and very short tentacles, and these organs may even entirely disappear. They may acquire every possible variety of form (figs. 5 & 6), but these changes take place far more slowly than in *Amœba*, and the modification figured by Ehrenberg in his great work appears to be the typical form.

Even the changeable *Amœbæ* have their typical forms,—such as the stellate (*A. radiosa*, Ehr.) and globular. It is often difficult to determine whether we have to do with a globular *Amœba*, or with an *Actinophrys* that has contracted its tentacles. The most certain character in this case is furnished by the contractile vesicle, which in *Amœba* lies deep in the body, but in *Actinophrys* quite on the surface. Further observations soon settle the question, as the doubtful animal will either extend the usual thin processes of *Actinophrys*, or convert itself into an unmistakeable *Amœba* by expanding its body, which I have never observed in *Actinophrys*. *Actinophrys Sol* is a very inactive creature, and I have never been able to ascertain how its movements are effected; nay, for some time I was even doubtful whether it was capable of any other movement than an extremely slow change of form, and the extrusion of the mucous substance. Nevertheless, the animal in its ordinary sun-like form is able to move slowly in a given direction, but during this movement no contraction of the body or bending of the tentacles is to be observed. I must therefore leave the nature of the movement undetermined, but the *Actinophrys* is far less active than its near allies the *Amœbæ*. Stein indeed thinks that the locomotion of *Actinophrys* is effected by the contractions of the contractile vesicle. But if this were the case, the movement must always take place in a direction opposite to the vesicle, a circumstance which I have not observed.

[To be continued.]

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

May 24, 1853.—Dr. Gray, Vice-President, in the Chair.

Notes on a Cetaceous Animal stranded on the North-east coast of Ireland.

By George Gulliver, F.R.S.

On Saturday, May 14, 1853, a herd of cetaceous animals appeared at Dundrum Bay, many of which got away, and others were stranded. I saw on the following days about twenty-five of them lying dead there on the sand. The largest was nearly nineteen feet, and the smallest between nine and ten feet long. They were all furnished with perfect teeth. The greater number were females; in a group of nine large ones, lying near together, six were females and three males.

I was told that their death-throes were dreadful; they rose on their tails, bellowed like bulls, floundered about, and spouted bloody sand and water, as they were attacked with different destructive instruments by the peasantry. From one of the animals, between sixteen and seventeen feet long, a perfect fœtus, presently to be described, was taken, so that the breeding time of this species may be considered as now determined One of them had the iron head of a harpoon imbedded in its back, and the wound completely healed over. In the second large compartment of the stomach were numerous fish-bones, completely denuded of all soft parts by digestion. The following measurements may be useful for future reference:—

Measurements of a Male.

	ft.	in.
Length from the snout to the end of the middle of the tail	18	6
Greatest girth, excluding back fin	12	6
Length of pectoral fin	5	0
Breadth of base of pectoral fin	1	0
Breadth of pectoral fin at one foot from its point	0	4
Length of base of back fin	3	0
Height of back fin	1	2
Breadth of tail from point to point	3	10

Measurements of a Female.

	ft.	in.
Length from snout to end of middle of tail	16	0
Greatest girth, excluding back fin	9	0
Girth one inch behind eyes	5	3
Length of each side of mouth	1	0
From snout to eye	1	6
From eye to blowhole	1	2
From snout to base of pectoral fin	2	10
The blowhole behind a line intersecting the eyes	0	1

	ft.	in.
From the snout to beginning of dorsal fin	4	11
From the end of the base of the dorsal fin to the end of the middle of the tail	8	6
From snout to vent	10	4
From snout to the orifice of the vagina	10	0
From snout to the mammary slits.	10	0
From point of lower jaw to the navel	6	0
From the eye to the angle of the mouth . . .	0	$4\frac{3}{4}$
The eye above a line drawn from the base of the upper jaw along centre of the sides of the body	0	3
From the knob of the snout to the upper lip .	0	10
Length of the mammary slit . .	0	$3\frac{1}{2}$
Transverse distance from mammary slit to orifice of the vagina	0	4
Dorsal fin at its base	2	6
Dorsal fin over its convexity	3	0
Height of dorsal fin	1	2
Length of pectoral fin	3	5
Breadth of base of pectoral fin	0	10
Length of opening of eyelid	0	$1\frac{1}{4}$
Diameter of eyeball	0	$1\frac{3}{8}$
Diameter of cornea	0	$1\frac{1}{8}$
Length of crown of tooth	0	$\frac{1}{8}$–$\frac{5}{8}$

Measurements of a Fœtus.

	ft.	in.
Length from snout to the end of the middle of the tail	4	8
Girth, excluding back fin	2	$5\frac{1}{2}$
From centre of snout to opposite the base of the pectoral fin.	1	0
Snout to beginning of the back fin	2	0
From the upper lip to the blowhole	0	9
From point of lower jaw to navel	2	1
From point of lower jaw to vagina . .	2	10
From the eye to the centre of the snout ..	0	7
Length of base of back fin . .	0	8
Height of back fin	0	3
Length of pectoral fin	0	$11\frac{1}{2}$
Breadth of base of pectoral fin	0	$3\frac{1}{2}$
Length of intestines	30	0

Anatomy.—Through the kindness of Mr. Brabazon, the excellent surgeon of Downpatrick, I had an opportunity of examining the fœtus of which the measurements have just been given. As the dissection was suddenly stopped, the details are imperfect, though accurate as far as they go. The skin was of a dark leaden colour, and the blubber on the sides of the body about half an inch thick. There were soft fringes or processes of the gums, corresponding in situation and number to the coming teeth.

The thymus of moderate size, at the usual situation in the chest, and sending no process to the neck. The spleen and a spleniculus together scarcely so big as a walnut. A flat rounded gland, about three-fourths of an inch in diameter, situated above the renal vessels on each side, and at a distance of upwards of an inch from the kidney, had more the appearance of a lymphatic gland than of the suprarenal body.

On opening the chest, each lung was seen to be covered with lymphatic vessels, running to a gland at the sterno-ventral aspect of the free edge of the lung. The gland was very juicy, had every appearance of a lymphatic gland, and measured one inch and a quarter long and five-eighths broad. This pulmonary gland in the adult is harder, more fibrous, and less juicy, and measures four and a half inches long by two broad.

The stomach with two chief compartments; the first continuing backwards on a line with the gullet, and lined, like it, with a white thick smooth membrane and epithelium; the second, or true digesting stomach, lined with a mucous membrane in folds, and somewhat smaller than the first, of a more rounded form, and extending from its middle to the duodenum. In the first was a quantity of thick, opake, whitish fluid, and in the second a little mucus.

There was no gall-bladder. The bile-duct, close to the duodenum, was as thick as a goose quill. The last portion of the intestine was full of meconium, like that of the human fœtus.

There was no cæcum; the intestines were nearly uniform in size throughout, their surface smooth and not at all cellulated. Length of the whole intestinal canal, from stomach to vent, thirty feet.

The kidneys large and lobulated throughout; the lobules from a quarter to half an inch in diameter, and having each a very delicate capsule of connecting tissue. The blood-vessels enter the kidney, not near its middle, but at its fore and inner or atlanto-mesial end.

The mesenteric glands moderate in size and number, of uniform consistency, and without any cavity or hollow in them, unlike those of the whale described by Mr. Abernethy.

The womb with two horns, and the ovaries in the usual situation; mammary slits on a level with and near to the orifice of the vagina. Urinary bladder empty, and the urethra opening just behind the clitoris.

Descriptive Characters.—Teeth conical and slightly curved inwards, from eight to twelve on each side of the jaws, making from thirty-two to forty-eight teeth altogether; but eleven on either side of each jaw is a common number, and there is sometimes one more in the upper than in the under jaw on each side. Dorsal fin large, convex above and extending behind into a hooked or curved point. Pectoral fins long, narrow, and tapering to a point. Tail crescent-shaped. Mouth sloping downwards and forwards. Eyes above and behind the angles of the mouth. Top of the head round, and not prominent, though the snout is remarkably so. No nipples yet protruding, but merely a longitudinal mammary slit on each side of the orifice of the vagina in the female; a large penis in the male. Skin smooth, shining, and black throughout, save two whitish-brown patches at the throat and near the vent and genitals; in a few males and females this light colour extends in a narrow strip from these points along the under part of the body, but never behind the eye, or elsewhere.

The blubber was 1⅝ths inch thick on the sides, much thicker on the back, and composing the whole thickness of the snout. The cuticle, which on its outer surface was like oil skin, when stripped off, exhibited on its under side a jet-black velvet-like rete mucosum, furnished with a very great abundance of black pigment. Around the eyeball was a firm bony plate in the sclerotic coat; and a white funnel-shaped ligament, extremely thick, tough and strong, was attached by its base to the eyeball, and surrounded the optic nerve.

As there is no opportunity here of consulting the published descriptions and figures of the Cetacea, I am uncertain at present of the species of this one. It does not correspond with any description in the Rev. Leonard Jenyns's 'Manual of the Vertebrata,' a copy of which is my travelling companion. The present animal approaches nearest to his Grampus (*Delphinus orca*) and Ca'ing Whale (*D. melas* of Traill and *D. deductor* of Scoresby). But it is smaller than either of them, though I suspect it will prove to be Traill's *D. melas*, and has not the white spot behind the eye, nor the broad pectoral fins of the Grampus, nor the very convex top to the head, the small average number of teeth (which he makes only twenty-four in all), nor the colour of the skin of his Ca'ing Whale. The animals which I examined had a convex rounded snout, its thickness made up of gristly blubber, which it is possible may have been erroneously described as the "top of the head." The Rev. Charles Archibald, whom I had the pleasure of meeting among the carcases, directed my attention to the difference between the pectoral fins of this species and those of the Grampus.

The relative position of the back fin, so much more forward in the adult than in the fœtus, is remarkable; and, indeed, the comparative measurements exhibit some interesting facts as to development.

Dundrum, co. Down, May 20, 1853.

Postscript.—The animal is undoubtedly the same as that described under the name of the Uyea Sound or Ca'ing Whale by Mr. Patrick Neill in 1806, and afterwards figured by Dr. Traill from a drawing by Mr. James Watson; by Cuvier; by Captain Scoresby, Mr. Bell, and Mr. Couch.

But though these figures are sufficient to identify the species, they all represent the pectoral fin as narrower at the base than it really is; and most of them show a twist of the tail, which was observed in none of the specimens at Dundrum Bay. Cuvier's plate is the only one that gives an idea of the pointed end of the dorsal fin; all the others represent this posterior termination of the fin too blunt, rounded, or short, though Mr. Couch correctly describes it as falcate.

No doubt, the fœtus, 4 feet 8 inches long, from Dundrum Bay, was nearly ready for birth in the middle of May. Dr. Traill mentioned sucklings five feet long in December 1806, at Scapay Bay, one of the Orkneys; Mr. Neill says that most of the adult females at Uyea Sound, Unst, were either pregnant, or giving suck to their toothless young, in February and March 1805; and in January 1812, in the neighbourhood of Paimpol, near the northern extremity of Bretagne, M. Lamaoüt found the young seven or eight feet long, and with cuttle-fish, cod, and milk in their stomachs.

M. F. Cuvier states that this species is remarkable for the spherical form of the anterior part of the head, and that his brother had named it "*globiceps*, à cause de la forme arrondie de sa tête." But the "very rounded top of the head," or "remarkably convex and prominent forehead," included by systematic writers in the specific characters of the Ca'ing Whale, and even among the otherwise judicious observations of Mr. Couch, does not properly belong to it; for the forehead of the skull is flat, as in other porpoises, though the prominent upper muzzle or snout-knob is sufficiently remarkable, and not badly represented in the plates already mentioned.

But, as I have caused a young skull to be sent to the British Museum, and Mr. Brabazon has presented a complete skeleton of the adult male animal to the same national collection, Dr. Gray has examined them, and that eminent zoologist has favoured me with the following note of the result:—"I have compared the skeleton with the species which have been usually described under the name of *D. globiceps*, and it would appear that the shape of the head of the animal scarcely justified that name; I can find no difference between the Irish and the other specimens."

June 14.—Dr. Gray, F.R.S., Vice-President, in the Chair.

Dr. Crisp exhibited the alimentary canal and ova of a Cuckoo (*C. canorus*), dissected on the 30th of May last. Some facts were observed that were thought of sufficient interest to place before the Society. A perfect egg was found in the oviduct, ready for expulsion, and about fifty in the ovary; two of the size of large peas, the others much smaller; a circumstance which tends to confirm the opinion that the eggs of this bird are deposited at intervals of seven or eight days.

The gizzard was lined with a hair-like substance, which, under the microscope, proved to be the spines from the legs of beetles. The gizzard contained a large quantity of the remains of the Cockchafer, and one of the Click-beetles, but no trace of a Caterpillar was discovered. In 1834 Mr. Thompson exhibited the gizzard of a Cuckoo at the Society (Proceedings, p. 29), and at first the hairy lining was supposed to be a natural structure, but Prof. Owen, on microscopic examination, believed that the hairs were from the larva of the Tiger-moth (*Arctia caja*).

Dr. Crisp thought the subject worthy of future inquiry, and that it would be important to ascertain whether this hairy lining is present in the *Caprimulgidæ* and other insectivorous birds. As regards the spines of the beetles and the hairs of the larva of the Tiger-moth, the microscope shows this important difference,—the *hairs* are all furnished with alternate lateral aciculæ; the spines of the beetles are smooth, with sharp points.

Explanatory drawings of the parts were exhibited.

Dr. Crisp also showed two new species of worms which he had recently obtained; one from the lung of the Egyptian Cobra (*Naja Hajé*) which had been in the Society's collection. It is 3 inches long, and its chief peculiarity consists in its annular protuberances, twenty-eight in number.

Dr. Baird has described this worm as a new species, in the British Museum Catalogue, under the name of *Pentastoma annulatum* *.

The other specimens were two nematoid worms, which Dr. Crisp obtained from the knee-joint of the common Coot (*Fulica atra*). They are of a cylindrical form, highly elastic, and coiled in a spiral manner round each other; the larger of the two, when extended, is about two inches in length, the smaller about an inch and a half, the extremities are tapering; the tail pointed; the head more orbicular. Under a power of 50 diameters, the alimentary canal can be distinctly seen.

Dr. Crisp believed that this worm had not been before described; it most resembled the *Spiroptera Falconis* of Rudolphi, or the *Spiroptera serpentulus* of Diesing. In the Museum of the London College of Surgeons (prep. 170) there are two *Filariæ*, one about six inches long, from the knee-joint of the Kangaroo (*Macropus major*): and Diesing, in his 'Systema Helminthum,' 1850, mentions the *Filaria subspiralis*, from the tendons of the foot of a Crane; and the *Spiroptera serpentulus*, from the leg and foot tendons of several species of Falcon.

ON A NEW SPECIES OF DENDROCOLAPTES.

BY PHILIP LUTLEY SCLATER.

The fine species of *Dendrocolaptes* which I now bring before the notice of the Society, was discovered by Mr. Wallace in the neighbourhood of Para. My specimen is from the Capin river, where it was collected in June 1849. A second, in Mr. Wallace's own collection, marked 'Para,' is the only other I have seen. Had I not the authority of Mr. Eyton and the Baron de la Fresnaye for considering the present bird as hitherto undescribed, I should hardly have ventured to characterize a species of this family, which is one of those most perplexing to ornithologists, by reason of the great similarity of colouring that pervades the group. The Baron de la Fresnaye, who has lately written a most complete monograph of these birds in the 'Revue de Zoologie,' has mentioned this species in a recent number of that periodical, under the MS. name I had proposed for it when on a visit to him eighteen months ago. This makes it desirable, I think, to give it specific characters at once, in order to avoid the evils of leaving a published name without a published description attached.

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* Described by Dr. Baird at p. 73 of the present volume of this Journal.

The specific name is in honour of Mr. Eyton, who has worked a great deal at the *Dendrocolaptinæ*, and published the results of his labours in the shape of descriptions of several new species, and a general list of the whole subfamily, in the 'Contributions to Ornithology' for last year.

Dendrocolaptes Eytoni, Sclater. *D. supra cinnamomeo-brunneus; caudæ colore intensiore, primariis intus ad apices obscurioribus; capitis collique superi plumis nigrescentibus, linea lata mediali fulvo-albida; subtus, mento et gula albis; pectore toto et ventre summo albido flammulatis, singulis plumis plaga mediali albida utrinque brunneo marginata; ventre imo et lateribus fulvis, tectricibus subalaribus pallide brunneis; rostro paululum incurvo; mandibula superiore nigrescente, inferiore corneo; pedibus nigris.*

Long. tota, 9–5; alæ, 4–0; rostri a rictu, 1–9; a fronte, 1–5.
Hab. in vicinitate Paræ, imp. Brasiliensis.

July 26.—Dr. Gray, F.R.S., Vice-President, in the Chair.

On some Staphylinidæ, found in the Nests of Termites. By M. Schiödte.

It has long been known that some species of ants keep insects belonging to different orders. The intention of the communication I am going to make is to point out that the same extraordinary phænomenon exists among the Termites.

The insects which I have now the honour to bring under the notice of the Society, dwell amongst a certain species of Termites in the Brazils, and were collected, together with the *Termes*, by Mr. Reinhardt, whilst travelling for the Royal Museum of Natural History in Copenhagen through the province Minas Geraes.

This *Termes* belongs to a peculiar little group of small species, the nests of which are built around branches of trees, and contain in their interior only a labyrinth of uniform passages, without any separate cell for the queen. The soldiers are not much larger than the working individuals, and are nearly as numerous; their head has its greatest dimension in the height; the front extends below in a large horn; the mandibles are not elongated, but exceedingly broad, and have a crenulated edge and a considerable horn on their outside.

From physiological as well as from anatomical reasons I am of opinion, that the constitutional state of the society of Termites is established on the same fundamental laws as the societies amongst the Hymenoptera. Several species of ants have also soldiers. The working Termites are quite different from the larvæ. In the species here mentioned they may be distinguished by the form of the *instrumenta cibaria*, especially by the two teeth at the end of the interior lobe of the maxillæ, which are separated by a pointed incision in the working individuals, but in the larvæ by a rounded one.

The strangers or guests of Termites known to me are *Staphylinidæ*, belonging to the group of *Aleocharini*; they constitute two new genera. They agree with *Lomechusa* and *Dinarda*, in having a corneous hook on the end of the interior lobe of their maxillæ, but in other respects they present characters in the construction of the parts of the mouth and of the tarsi, which strikingly separate them from all other genera of that group. The abdomen is constructed in a most extraordinary manner, being membranaceous, of an enormous size, bent upwards so as to cover the thorax, and fixed in this position by the dorsal faces of the second and third segments having grown together.

Of one of the genera, which I have named *Corotoca*, two species are known to me (*Corotoca Melantho* and *C. Phylo*); they are about 3 millim. in length from the front to the end of the second segment of the abdomen Of the first of these I have observed both sexes. The male is a little smaller than the female, but otherwise only to be distinguished by the dissection of the organs of generation.

Of the other genus, named by me *Spirachtha*, the male is still unknown to me. The abdomen is furnished with three pairs of appendages, which are elongate, cylindrical, 2-jointed, membranaceous, and moveable by muscles at the base. These appendages are perhaps intended for the same purpose as the tufts of hairs on the abdomen of the genus *Claviger*, which are known to be sucked by the ants, even in *Lomechusa* there are similar hairy appendages on the sides of the abdomen. Of this genus only one species is known to me (*Spirachtha Eurymedusa*), of about 2 millim. in length, from the front to the end of the second segment of the abdomen.

In the abdomen of both genera I have found eggs in different stages of development, in *Corotoca* even eggs with fully developed larvæ; so that, beyond doubt, these animals are viviparous.

If the *Strepsiptera* are to be considered as belonging to the order *Coleoptera*, an opinion which I endeavoured to prove as early as the year 1840[*], this will be the *second* instance of viviparous *Coleoptera*.

Fam. STAPHYLINI.

Trib. ALEOCHARINI.

Genus COROTOCA.

Maxillæ mala interiori cornea, uncinata. Palpi maxillares 4-articulati. Ligula lata, rotundata, paraglossis obsoletis. Palpi labiales 3-articulati. Tarsi 4-articulati, posteriores articulo primo valde elongato. Abdomen membranaceum, fractum, parte posteriori fixa, maxima, globosa, dorso anteriori animalis superposita. (Κόρη, τίκτω.)

1. COROTOCA MELANTHO. *Fusca, fronte foveolata, pronoto multifoveolato, disco bituberculato; tibiis posterioribus fusiformibus, fuscis; scutis ventralibus segmenti quarti quintique transversis.*—Mas, Fem.

Long. a fronte ad apicem segmenti secundi abdominis 2½–3 mill.

2. COROTOCA PHYLO. *Fusca, vertice foveolato, pronoto multi-*

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[*] See the introduction to 'Danmark's Eleutherata,' p. 21, note.

foveolato, disco trituberculato; tibiis posterioribus linearibus, nigro-fuscis; scutis ventralibus segmenti quarti quintique subquadratis.—Fem.

Long. a fronte ad apicem segmenti secundi abdominis 2⅓–3⅓ mill.

Genus SPIRACHTHA.

Maxillæ mala interiori cornea, uncinata. Palpi maxillares 3-articulati. Ligula ampla, rotundata, paraglossis obsoletis. Palpi labiales 3-articulati, minutissimi, verruciformes, ligula supertecti. Tarsi 4-articulati, posteriores articulo primo subelongato. Abdomen membranaceum, maximum, fractum; parte anteriori articuli secundi globosa; parte posteriori fixa, conica, anterius ascendente, tribusque utrinque munita appendicibus membranaceis, filiformibus, biarticulatis. (Σπειραχθὴς)

SPIRACHTHA EURYMEDUSA. *Albissima, membranacea, antennis, capite, scutis thoracicis et abdominalibus pedibusque corneo-membraneis, pallide fuscis, coxis, femorum basi, trochanteribus posticis tibiisque fuscis, oculis fusco-nigris.*—Fem.

Long. a fronte ad apicem segmenti secundi abdominis 2 mill.; lat. segmenti secundi abdominis 1 mill.

November 8.—Dr. Gray, Vice-President, in the Chair.

ON THE ANATOMY OF THE WALRUS.
BY PROFESSOR OWEN, F.R.S., F.Z.S. ETC.

Professor Owen communicated the chief results of his dissection of the Walrus (*Trichecus rosmarus*) which died at the Gardens of the Zoological Society, October 1853. The author prefaced his anatomical description by some remarks on the physiognomy, attitudes and movements of the living animal; and more especially dwelt on the superior strength of its fin-shaped limbs, as compared with the ordinary Seals, the Walrus being able, when it moves on dry land, to raise its trunk from the ground—in other words, to walk—a mode of progression which strikingly contrasts with the awkward shuffle of the Seal, as it trails its belly on the earth, aiding its fore fins with the action of its powerful abdominal muscles. Both the bones and muscles of the fins of the Walrus are more powerfully developed than in the Seal, and this, the author concluded, had reference to its natural habitat among bergs and floes of ice, and the necessity of clambering among and over their rough, irregular surfaces. The sex of the animal dissected was female; the mammæ were four in number, two abdominal and two inguinal. There was no trace of external ears. The eye is defended by a circular external eyelid, and by a broad thin *membrana nictitans*; there is a small Harderian, or inner lacrymal gland, but no true lacrymal gland, *punctum lacrymale*, nor *ductus ad nasum*. The subcutaneous cellular tissue was very coarse, tough and elastic, almost granular to the touch, and resembling a *corpus cavernosum*. The disposition of the peritoneum and of the viscera of the abdomen was minutely described, and it was

remarked that the odour of the visceral cavities and parts in this Walrus resembled more that of ordinary land quadrupeds than the peculiar odour noticed in the dissection of Seals; but the flesh of the Walrus was dark coloured, as in the Seal tribe: the young animal dissected, had been fed, since its captivity, on oatmeal, milk, and water. The stomach had the form of an elongated siphon closely bent upon itself. The liver was divided into seven lobes. There was a large gall-bladder. The intestines in this young animal, which did not exceed four feet in length, were seventy-five feet long, the great intestine being only one foot in length, and the *cæcum coli* one inch and a half. The kidneys were very complex, each being made up of about 400 small kidneys or renules, and each of these showing the normal structure of a simple kidney, such as is found in the dog or lion, viz. with the cortical and medullary part, the pelvis, mammilla and ureter. In the description of the viscera of the chest, the large thymus gland was noticed, and the notched or serrated character of the anterior margin of the lungs. The *foramen ovale* and *ductus arteriosus* were both obliterated.

The following is the description of the heart of the Walrus:—The blood is returned into the right auricle by a large precaval and postcaval vein, and by the coronary vein, which terminates close to the latter: there is a small semilunar valve at the coronary orifice, but no eustachian valve. A broad crescentic fold, looking downwards, divides the sinus or fossa receiving the precaval vein, from the larger and deeper one receiving the postcaval vein: this fold answers to the upper border of the 'fossa ovalis' in the human heart; there is no orifice in the 'fossa' communicating with the left auricle. The appendix of the auricle extends in front of the base of the aorta as far as the pulmonary artery; it gradually contracts to an obtuse point: in the *Cystophora proboscidea* the auricular appendix is short, broad and bifid; in both it is occupied by a reticular arrangement of carneæ columnæ. The ventricles are broader in proportion to their length, and the apex is not produced, as in the *Cystophora proboscidea*: the carneæ columnæ of the anterior division of the tricuspid valve, and a few of those of the right or external division, are attached to a short and thick fleshy column from the free wall of the ventricle; this column is connected by a short and thick 'trabecula' with the septum: most of the other tendinous chords are attached to the septum; and a few to trabeculæ connecting that fixed wall with the free wall of the ventricle. The pulmonary artery presents no peculiarity; it is connected by the ligamentous remnant of the 'ductus arteriosus,' which is 10 lines long and 5 lines in diameter, to the under part of the aortic arch, just beyond the origin of the left subclavian; its cavity is obliterated, but a short, thick, semilunar fold of the lining membrane of the aorta, with its concavity turned towards the end of the arch, indicates the place of the former fœtal communicating channel. The left auricle and ventricle offer no peculiarities. The coats of the aortic arch are thickest near the origins of the great vessels sent to the head and fore-limbs, especially at the lower part of the arch, where they are 3 lines thick. The right subclavian and carotid arise close together, but scarcely from a common trunk: the left carotid and left subclavian have more obviously separate origins. The aorta suddenly diminishes beyond those primary branches, where it is connected with the consolidated and contracted 'ductus arteriosus.' There is no arrangement, even in the very young Walrus here described, for accommodating the animal to its aquatic habits, by any direct intercommunication between the right and left sides of the heart. The hepatic veins, in their dilatations, resemble those of the ordinary Seals.

The brain weighed 1 lb. 9 oz. avoir.; its convolutions and structure were described. The hip-joint was found to be devoid of the ligamentum teres. Drawings were exhibited of the viscera of the thorax and abdomen, and the Memoir was terminated by a minute account of the dentition, and a disquisition on the homologies of the teeth of the Walrus, as elucidated by the state of the dentition in the young animal dissected.

Professor Owen detected the following minute teeth exposed or buried in the gum, and adhering to the gum and periosteum of the jaws:—two denticles in each premaxillary bone, two denticles in each maxillary bone; together with a deciduous canine, and four denticles in each ramus of the mandible. He gave the following as the formula of the deciduous dentition of the Walrus:—

$$i\,\frac{2-2}{2-2},\ c\,\frac{1-1}{0-0},\ m\,\frac{2-2}{2-2}=18.$$

Of the permanent series, the canine tusks had pushed through the gum, and on laying open the substance of the jaws, the following teeth were found in course of formation:—in the premaxillary, the successor of the second minute incisor; in the maxillary, the successors of the two deciduous molars, together with a third molar. In the lower jaw the successor of the second deciduous incisor, the successors of the two deciduous molars, and a third similar permanent molar. The germ of the permanent tusk, confined to the upper jaw, was 2 inches in length, and, like the germs of the smaller permanent teeth, its base was widely open, and contained a large formative pulp.

In addition to the upper canine tusks, the normal number of permanent and functional teeth in the Walrus is four on each side of both jaws; these teeth are simple, short, thick and obtuse, having the office of grinders. With respect to their nature and homologies, Professor Owen argued that the first, from its position in the premaxillary bone, was an 'incisor'; the two following teeth, by their position in the maxillary bone, and their relation to the deciduous denticles, were 'premolar' teeth; and he also regarded the last of the series of four, from its minor degree of development, as belonging rather to the same (premolar) series, than as being the first of the true molars. As the first of the molariform permanent teeth in the lower jaw passes in front of the permanent incisor above, when the mouth is closed, it must be regarded as an 'incisor'; the other three grinders as being 'premolars,' two being proved to be such by displacing vertically their predecessors, and the third also appearing to be of the same series by its state of development. The Professor accordingly proposed the following as the formula of the normal or functional dentition of the Walrus:—

$$i\,\frac{1-1}{1-1},\ c\,\frac{1-1}{0-0},\ p\,\frac{3-3}{3-3}=18.$$

But, as might be expected in a dentition deviating so remarkably from that of other Mammals of the same order, varieties are not unfrequently met with in the number of the teeth of the Walrus. Professor Owen cited instances of such varieties in ten skulls of the Walrus, of different ages and sex. The result of which was, that occasionally a small tooth was found anterior to the normal series of four, and more commonly in the upper than in the lower jaw, and that, more rarely, a small tooth was superadded behind the normal four, in the upper jaw, and still more rarely in the lower jaw: the formula of the dentition of such varieties, in excess, being,—

$$i\,\frac{2-2}{2-2},\ c\,\frac{1-1}{0-0},\ p\,\frac{3-3}{3-3},\ m\,\frac{1-1}{1-1}=26.$$

The additional anterior small incisor was due either to the retention and growth of the first deciduous denticle, or to the development of a small successor to it. The additional posterior grinder was due to the occasional development of a germ in the back part of the gum or jaw. The minute milk-teeth relate, by their gubernacula, to the development of the permanent teeth, but seem never to be put to use themselves; the milk canine was buried in the gum outside the protruded point of the permanent canine, so that this tooth is extricated and cuts the gum before the tooth of which it is the successor makes its appearance, that tooth being probably removed by absorption. Here, therefore, was another instance, analogous to that of the rudimental teeth in the fœtal Whale, of parts developed without any obvious office as organs of mastication, but serving to illustrate the relation of adhesion to a more normal type of dentition. In conclusion, Professor Owen remarked that the food of the Walrus consisted, in a state of nature, of sea-weed, crustaceans and mollusks, and that although, by the totality of its organization, it must be placed near the Seals, and with them be classed in the order *Carnivora*, yet that the incisors and premolars were alike well adapted to pound marine plants, and to break and crush shells. Fragments of a bivalve shell, a species of *Mya*, had been found with pounded sea-weed, by the Surgeon of Parry's Polar Expedition, in the stomach of a full-grown Walrus. The great descending canine tusks serve as weapons of offence and defence, and to aid the animal in mounting and clambering over ice-blocks, bergs and floes in the Arctic Seas, in which the Walrus has been organized to enjoy its existence.

ROYAL SOCIETY.

November 23, 1854.—Thomas Bell, Esq., V.P., in the Chair.

"On the Impregnation of the Ovum in the Stickleback." By W. H. Ransom, M.D.

I purpose placing before the Royal Society in this communication, the principal results of experiments made during the months of June and July last, on the impregnation of the ovum in *Gasterosteus leiurus* and *G. pungitius*, and hope to be able to furnish a more detailed account of my observations on a future occasion.

The ovarian ovum of these fishes, at a very early stage of its development, is provided with a proper investing membrane, the future chorion. At a later period, one portion of this membrane presents a number of cup-shaped pediculated bodies scattered over its surface, and in the centre of this part of the chorion there is a funnel-shaped depression, pierced by a canal which leads towards the centre of the egg.

In the nearly ripe ovum, the germinal vesicle occupies an excentric position with respect to the egg as a whole, but imbedded in the centre of a semi-solid accumulation of fine granular matter at that part of the surface which corresponds to the funnel-shaped depression , so that the apex of the funnel, projecting inwards beyond the level of the inner surface of the chorion, makes a depression in the centre of the layer of granular matter, and comes nearly into contact with the germinal vesicle.

For convenience of description, the funnel-shaped depression will now be called *micropyle*, and the layer of granular matter before impregnation, *discus proligerus*.

The germinal vesicle disappears before the ovum leaves the ovary, and no remnant of it or its spots can be seen.

A very delicate membrane invests the yelk within the chorion; this membrane is more distinct after impregnation, or after the action of water upon an unimpregnated egg; it may be isolated, and then exhibits a remarkable degree of elasticity. It is not a *yelk-membrane*, and it will be spoken of as the *inner membrane*.

The layer of the yelk immediately internal to the inner membrane passing over the discus proligerus, is formed by yellowish highly refractive drops which disappear in water, undergoing some remarkable changes, and by a fluid substance which water precipitates in a finely granular form.

The principal mass of the yelk consists of a clear and very consistent albumen. The oil is collected into a few very large drops which come up to the surface.

When the ovum escapes from the ovary, it enters a cavity which may be considered as the ovarian extremity of the oviduct, in which a considerable quantity of clear viscid fluid is previously secreted and collected, to be expelled with the ova.

More exact observation of the micropyle in the free eggs proves that the inner end of the canal is either open, or at most closed by a very delicate membrane. When looking into the funnel from the wide mouth, the apex being in focus, a bright, clear, round or oval spot, such as an aperture would produce, is always visible. If a section be made of the egg, and the apex brought into focus from within, the same clear spot is well seen, and the fine and regularly dotted structure of the chorion is seen to cease suddenly at the margin of the clear spot.

The general form of the egg after deposition is round, but it is rendered irregular by indentations caused by the pressure of other eggs. It is inelastic, and retains impressions made in it by a needle; and when placed in water, these characters remain for a long time if it be not impregnated,—a fact which indicates that water does not pass through the micropyle, or by imbibition through the chorion. The viscid secretion of the oviduct which invests the eggs may defend them against the action of water, in which it does not readily diffuse or dissolve. This secretion has an alkaline reaction. The substance of the yelk has a decidedly acid reaction,—more than enough to neutralize the alkalinity of the viscid secretion. This reaction is, I believe, due to a peculiar organic acid, but the experiments relating to this question are not yet complete. The seminal particles of the male continue to move for a considerable period in the viscid secretion which envelopes the ripe ova, but they very quickly become still in water.

In the act of impregnation one or more (as many as four have been seen) spermatozoids pass into the micropyle, and probably by their proper motion overcome the obstruction which prevents the entrance of water. Actively moving spermatozoids may remain in contact with the chorion for eighteen minutes at least without producing any sensible change in the ovum, provided none of them enter the micropyle, but when one is seen to enter, in about a quarter of a minute a change is observable.

The changes which are observed to follow the entrance of the spermatozoids into the micropyle are the following —In about a quarter of a minute the tube is shortened, and very soon a clear space becomes visible within the chorion near the micropyle: this space, or respiratory chamber, gradually extends to the opposite pole of the egg and increases in diameter, as does also the whole ovum. During the formation of this space the surrounding fluid enters through the micropyle, and this gradually retracts and is at length closed. This entrance of fluid into the egg effaces the depressions, restores the round form, and makes it firm and elastic; but does not cause any such precipitation of granular matter as is produced by its artificial introduction.

While the respiratory chamber is yet in progress of formation, the yellow drops of the superficial layer of the yelk grow pale and disappear; the change beginning near the micropyle. As a result of this, the whole egg becomes clearer, and the *discus proligerus*, which may be now more correctly denominated the *germinal mass*, is more distinct.

The yelk now very slowly alters its form, one surface becoming flattened; but about fifteen or twenty minutes after impregnation a remarkable and more vivid contraction begins, causing the yelk to pass through a series of regularly recurring forms. The contraction begins on one side near the equator, and soon forms a circular constriction which gives the yelk the figure of a dumb-bell, the longer axis of which is the polar axis of the egg. The constriction travels towards the germinal pole, and next produces a flask-shaped figure;

this is at length lost by the constriction passing on, and the round form is regained in about a minute. This wave reappears and travels forward again without any distinct period of rest, and I have seen these movements continue for forty-five minutes, though towards the latter part of this period they are less distinct and more limited in extent. The germinal mass has itself during these contractions, which strongly resemble the peristaltic movements of the intestine, undergone changes in form, and has increased in bulk and distinctness. These movements are unaffected by weak galvanic currents.

During the passage forward of each wave of contraction there is an oscillation of the whole mass of the yelk, so that its germinal pole passes once to the right and once to the left of the micropyle, to which it at first corresponded The plane of this oscillation may be vertical, horizontal, or inclined, but always cuts the micropyle; it begins and ceases with the contractions already mentioned, and would seem to be a mechanical result of them.

For some time before cleavage begins, the only changes of form are the appearance of wave-like elevations and depressions along the under surface of the germinal mass, and its alternate concentration and diffusion Cleavage begins in about two hours after impregnation; no embryonic cell was observed before it began, nor in any of the cleavage masses.

The inner membrane is folded in during cleavage, it is easily seen thrown into folds at the cleft, and for this reason I do not consider it a *yelk-membrane*, which term would be better applied to the chorion.

December 21, 1854.—The Lord Wrottesley, President, in the Chair.

"Remarks on the Anatomy of the *Macgillivrayia pelagica* and *Cheletropis Huxleyi* (Forbes), suggesting the establishment of a new genus of Gasteropoda." By John D. Macdonald, R.N., Assistant-Surgeon H.M S. Herald.

Having examined the anatomy of the *Macgillivrayia pelagica* and several smaller species of pelagic Gasteropoda, not exhibiting the least similarity in the character of their shells, the author found that they all presented a very close relationship to each other in the type of their respiratory organs, and in other points of structure of less importance.

The gills in every instance seemed to be fixed to the body of the animal immediately behind the head, and did not appear to be appended to the mantle, as in the Pectinibranchiata properly so called. They were also invariably four in number, and arranged in a cruciform manner round a central point. They were free in the rest of their extent, elongated and flattened in form, with a pointed extremity, and fringed with long flowing cilia, set in a frilled border. They were, moreover, furnished with muscular fibres, both transverse and longitudinal, and exhibited great mobility when protruded, but lay side by side in the last whorl of the shell when retracted.

The auditory capsules, each containing a spherical otolithe, were closely applied to the inner and posterior part of the larger or anterior ganglion of the subœsophageal mass.

There were two tentacula, each bearing at the outer side of its base an eye consisting of a globular lens with optic nerve and retinal expansion The foot was large and very mobile, but a vesicular float has been observed only in *Macgillivrayia*.

The respiratory siphon was either a simple fold of the mantle forming a temporary tube (*Cheletropis*), or a fold whose borders were united through their whole length, leaving an aperture at the end, as in *Macgillivrayia*.

A lingual ribbon with well-marked rachis and pleuræ occurs in all the species. Very perfect labial plates with closely-set dental points arm the mouth in some instances, and probably in all.

The little animals possessing in common the characters here described, nevertheless fabricate shells so very different as to admit of their division into well-marked genera

The author conceives that the obvious difference between the pectinibranchiate type of respiratory organs and that observed in the group of Gasteropoda now under consideration, affords sufficient grounds for placing the latter in a distinct order by themselves; and as illustrations of it he proceeds to give some details of the structure of the two species mentioned in the title of the paper, whose shells have been already described by the late Prof. E. Forbes, and figured in Mr. Macgillivray's 'Narrative of the Voyage of H.M.S. Rattlesnake.'

In *Macgillivrayia* the disc of the foot is broad and connected by a narrow attachment to the body just beneath the neck; it carries an operculum behind, and is cleft by a notch in front. A raphe observable in the median line, as well indeed as the whole character of this part of the organ, seems to shadow forth the transformation of the single foot of the Gasteropod into the wing-like expansion of the Pteropod.

After describing the labial plates and lingual strap, the eyes and the branchiæ, the author observes that the tubular siphon protrudes from the shell on the left side and seems to indicate the coexistence of a respiratory chamber with naked branchiæ.

The vesicular float, like that of *Ianthina*, noticed by Mr. Macgillivray, consists of an aggregation of vesicles varying both in number and size in different cases. It is exceedingly delicate, and could not be found in the specimens first obtained, having probably been destroyed or detached from the foot by the force of the water running through the meshes of the net with which they were captured. Its coexistence with an operculum shows that it is not a modification of the latter.

Of the *Cheletropis Huxleyi*, numerous specimens were found in Bass's Straits and in the South Pacific, between Sydney and Lord Howe's Island.

After giving some details respecting the shell and the foot, the author observes that the latter organ was destitute of float, at least in the specimens he obtained, but was furnished with an operculum, which, probably from its extreme thinness and smallness, had escaped the notice of Professor Forbes. He then points out the peculiarities of the respiratory apparatus.

The portion of the mantle which forms the respiratory siphon, is short, and its opposite edges are merely in apposition, without organic union. The branchiæ are of two kinds, covered and naked. The covered gill is single but of considerable length. It is beautifully pectinated, and fringed with long cilia, and, doubtless, represents the respiratory organ of the pectinibranchiate Gasteropoda. The basis of this part is a long and narrow strip of a tough and fibrous material, folded upon itself into a series of loops invested with a coating of epithelium, and richly ciliated along the free border. The naked gills are four in number, similar both in situation and character to those of *Macgillivrayia*. Each gill is of an oval or elongated form, presenting a thin, frilled and corrugated border, beset with long whip-like cilia. In the central parts muscular fibres are distinctly discernible, some disposed lengthwise and others transversely.

The lingual strap is next described, as well as two file-like triturating plates with which the mouth is furnished.

The two tentacula of each side appear as it were enclosed in one envelope, so as to form a single tactile instrument, which bears a large dark eye on its outer side near the base. To this latter organ the tegumentary covering forms a kind of cornea, beneath which is a spherical lens resting on a mass of black pigment, both being enclosed in a little sac; and the optic nerve, emerging from the sub-œsophageal ganglion, joins the miniature globe and expands into a retina. The author was unable to trace an opening through the pigment for the passage of light, but thinks it probable that, as in the ocelli of insects, such an aperture exists in the central part. The auditory capsules are situated at some distance behind the eyes, and may be distinctly seen with the microscope when the surrounding parts are carefully removed with fine needles. They are of a rounded or oval form, and each contains a beautifully transparent and highly refracting otolithe, much larger than the lens of the eye.

January 11, 1855.—Thomas Bell, Esq., V.P., in the Chair.

"On the Development of Muscular Fibre in Mammalia." By William S. Savory, M.D.

The author's observations were made chiefly upon fœtal pigs, but they have been confirmed by repeated examinations of the embryos of many other animals, and of the human fœtus.

If a portion of tissue immediately beneath the surface from the dorsal region of a fœtal pig, from one to two inches in length, be examined microscopically, there will be seen, besides blood-corpuscles in various stages of development, nucleated cells and free nuclei or cytoblasts scattered through a clear and structureless blastema in great abundance. These cytoblasts vary in shape and size; the smaller ones, which are by far the most numerous, being generally round, and the larger ones more or less oval. Their outline is distinct and well defined, and one or two nucleoli may be seen in their interior as small, bright, highly refracting spots. The rest of their substance is either uniformly nebulous or faintly granular.

The first stage in the development of striated muscular fibre consists in the aggregation and adhesion of the cytoblasts, and their investment by blastema so as to form elongated masses. In these clusters the nuclei have, at first, no regular arrangement. Almost, if not quite as soon as the cytoblasts are thus aggregated, they become invested by the blastema, and this substance at the same time appears to be much condensed, so that many of the nuclei become obscured.

These nuclei, thus aggregated and invested, next assume a much more regular position. They fall into a single row with remarkable uniformity, and the surrounding substance at the same time grows clear and more transparent, and is arranged in the form of two bands bordering the fibre and bounding the extremities of the nuclei, so that now they become distinctly visible. They are oval, and form a single row in the centre of the fibre, closely packed together side by side, their long axes lying transversely, and their extremities bounded on either side by a thin clear pellucid border of apparently homogeneous substance.

It is to be observed how closely the muscular fibres of mammalia at this period of their development resemble their permanent form in many insects.

The fibres next increase in length and the nuclei separate. Small intervals appear between them. The spaces rapidly widen, until at last the nuclei lie at a very considerable distance apart. At the same time the fibre strikingly decreases in diameter; for as the nuclei separate, the lateral bands fall in and ultimately coalesce.

This lengthening of the fibre and consequent separation of the nuclei is due to an increase of material, and not to a stretching of the fibre.

Soon after the nuclei have separated some of them begin to decay. They increase in size; their outline becomes indistinct; a bright border appears immediately within their margin, their contents become decidedly granular; their outline is broken and interrupted; and presently an irregular cluster of granules is all that remains, and these soon disappear.

It sometimes happens that the nuclei perish while in contact, before the fibre elongates; but the subsequent changes are the same.

The striæ generally first become visible at this period, immediately within the margin of the fibre.

The fibre is subsequently increased in size, and its development is continued by means of the surrounding cytoblasts. These attach themselves to its exterior, and then become invested by a layer of the surrounding blastema. Thus, as it were, nodes are formed at intervals on the surface of the fibre. These invested nuclei are at first readily detached, but they soon become intimately connected and indefinitely blended with the exterior of the fibre. All its characters are soon acquired, the nuclei at the same time gradually sink into its substance, and an ill-defined elevation, which soon disappears, is all that remains.

Lastly, the substance of the fibre becomes contracted and condensed. The diameter of a fibre towards, or at the close of intra-uterine life, is considerably less than at a much earlier period.

At the period of birth muscular fibres vary much in size.

The several stages in the development of muscular fibre, above mentioned, do not succeed each other as a simple consecutive series; on the contrary, two, or more, are generally progressing at the same time. Nor does each commence at the same period in all cases.

BOTANICAL SOCIETY OF EDINBURGH.

January 11th, 1855.—Professor Balfour, President, in the Chair.

A letter was read from Dr. Senoner, Vienna, in which he remarks: —"I beg your attention to the specimens of Auer's new discovery of 'natural self-printing,' which must be of importance to the interests of botany, especially to the study of the Cryptogamics. As yet the discovery has been but little applied practically. Von Heufler has published the Cryptogamic Flora of the valleys of the Siebenburgen with illustrations of this kind Von Ettingshausen has by this means given figures of the forms of the leaves in the Euphorbiaceæ; and there is now appearing at Trieste the Flora of Northern Italy, in drawings of this kind, of which no descriptive text has yet been published, but only the figures, with the addition of the names, the classification, and the different stations of the plants. The first fasciculus has appeared. The delineation is not so correct and clear as in Auer's self-printing, but it may be expected to be extended and improved. In Tyrol also there is coming out by Ambross a Flora of the 'Tirolo Meridionale,' which is scientifically written, and gives, in conjunction with Hausman's published Flora of Tyrol, a distinct view of the Flora of that country, which still, however, conceals many treasures."

Dr. Balfour read some observations by Mr. Quarles Harris on the Vine disease.

"The first attack," says Mr. Harris, "I conceive to have been from without, and to have fallen upon the leaves and fruit, in the form of very minute and (to the naked eye) invisible sporules of a peculiar fungus, formerly either unknown to, or not noticed by botanists, perhaps because its blasting and destructive powers were never before called into action. The Vine is thus covered with these small cryptogamic germs, which are introduced into the cells and vessels, and carried to all parts of the plant.

"The following spring, on the rising of the sap, the disease shows itself in the new shoots and in the bloom heads, and every infected vine spreads ruin around it in every direction, the spores ripening rapidly, and scattering thousands of sporules, which, wafted by every breeze, settle on the neighbouring vines.

"After the most laborious experiments and investigations, in which I have had the assistance of intelligent practical botanists and chemists, I cannot refer the first attack to anything but atmospheric influences and disturbances, causing an unhealthy state of the vines, thus rendering them a fit prey to this fungus (the germs of which are floating in the air), and unable to resist its insidious attacks.

"It would require that I should write a volume rather than a letter, were I to attempt to give a complete history of my experiments. I see in my brother's present letter a confirmation of my own experience as to the new shoots and flower-buds absolutely bursting forth covered with filaments of the *Oïdium*."

The following papers were read:—

1. "Notes on the Flora of Dumfries," by W. Lauder Lindsay, M.D.

The author's remarks applied to the district immediately around Dumfries, radiating to a varying distance of five to ten miles from the centre.

His object was not so much to mention the floral treasures of the county, as to call attention to the fact of the extreme luxuriance of the common vegetation, not having noticed in any other part of this country, or in any other countries, our common wild plants growing to such a height or in such profusion.

2. "Notice of Plants in the neighbourhood of Oban, and in part of the Island of Mull," by David Philip Maclagan, Esq. The author having resided at Oban during the months of August and September last, had spent part of his time in examining the botany of the neighbourhood, and now laid before the Society a notice of some of his excursions, and a list of all the plants observed, amounting to about 400 species.

3. "On Plants found in Strachur, Argyleshire, and in Roxburghshire," by W. Nichol, Esq.

4. "On Lichens collected on the Breadalbane Mountains and Woods," by Hugh Macmillan, Esq.

5. "On Harmonious Colouring in Plants," by Professor M'Cosh.

MISCELLANEOUS.

On the Movements and Reproduction of the Naviculæ.

By M. Focke.

The author, like Ehrenberg, refers the *Diatomaceæ* to the animal kingdom. According to his account the movements of the *Naviculæ* are effected by means of a kind of temporary, exsertile and retractile, foot, which passes through openings discovered by the author on the sides of the carapace.

According to M. Focke, the reproduction of some species of *Naviculæ* presents a strange complication of the phænomena of "alternation of generations" and conjugation; *Navicula bifrons*, for example, forms by the spontaneous division of its internal substance, spherical bodies which like gemmules give rise to *Surirella microcora*. These by conjugation produce *N. splendida*, which gives rise to

N. bifrons by the same process. This last gemmation has been observed by the author in all its phases. He saw two specimens of *N. splendida*, enveloped in a sort of mucosity, open and evacuate the whole of their contents, which served to form a *N. bifrons*. The production of the reproductive bodies by the latter was also observed; but their development into *Surirella microcora* and the production of *N. splendida* by conjugation rests entirely on the inductions of the author.

These facts require revision and confirmation, but they are still worthy of the attention of observers, and appear to point to phænomena quite as singular as those which have been revealed to us within the last few years by the study of the reproduction of so many of the lower animals. They in fact present in a manner the converse of the phænomena exhibited in the ordinary alternation of generations, as several germs or eggs are necessary for the production of the last individual of the cycle.—*Comptes Rendus*, Jan. 22, 1855, p. 167.

On Lottia zebrina *and* L. Scurra. By Dr. J. E. Gray.

In the Philosophical Transactions for 1833, I referred these common Peruvian Mollusca to the genus *Lottia*. If I recollect rightly, M. D'Orbigny, in his 'Voyage to South America,' from the examination of some animals of these shells in Paris, figures these animals, and refers them to the genus *Patella*; and putting faith in the accuracy of this determination in the Catalogue of M. D'Orbigny's collection, which has lately been transferred to the British Museum, I observed, "These are *Patellæ*, and not *Lottiæ*." In the Mollusca collected by M. Souleyet during the voyage of the '*Bonite*,' which have lately been acquired by the Museum, there are several specimens of this shell, belonging to two of the varieties of it which M. D'Orbigny has regarded as distinct species, and, on examination of the animals, they prove to be *Lottiæ*, and not *Patellæ*;—peculiar, like *Lottia Scurra*, for having a series of rather large beards round the inner edge of the mantle; and I suppose M. D'Orbigny must have mistaken these beards for the gills, and thus made the mistake which I am now desirous of rectifying. The gill of *Lottia zebrina*, and of several other species without or with only very rudimentary beards on the mantle-edge, as *L. punctata*, is free and floating in the nuchal mantle-cavity for the greater part of its length, while the gill of *L. Scurra*, the type of the proposed genus *Scurria*, is attached by its outer or left edge to the inner surface of the mantle, which induced me, with its peculiar habits, to regard it as a genus distinct from *Lottia*.

Description of a new species of Sorex, *from India.*

By R. Templeton.

Sorex? purpurascens, n. sp.

Dark slate-coloured, with a tinge of purple; snout beneath and lower lip brownish, with a mesial groove above, running back half the distance to the eyes; front covered with black hairs having white tips, and gradually increasing in length as they extend backwards to the eyes, and arched a little forwards; eyes small and very black; ears nearly naked and slaty brown; belly slaty grey; legs slaty brown, thinly covered with short greyish hairs, which project in a little tuft over each claw, beneath naked; the toes with eight or nine transverse wrinkles; tail about two-thirds as long as the body, covered with short bristly hairs, and appearing beyond the middle somewhat grey from white annular wrinkles; furnished for about two-thirds of its length with long black bristly hairs.

Length of body, 2½ inches; tail, 1¾.—*Proc. Zool. Soc.* July 26, 1853.

METEOROLOGICAL OBSERVATIONS FOR JAN. 1855.

Chiswick.—Jan. 1. Cloudy: boisterous. 2 Densely clouded: slight rain: overcast and mild 3. Very fine. 4. Overcast. 5 Very fine. 6 Overcast 7. Densely clouded. 8 Overcast. 9. Fine slight rain 10. Foggy very dense fog at night 11. Foggy. 12. Foggy. hazy clouds. 13 Overcast: fine. cloudy clear and frosty. After unusually fine dry weather, a most severe period now commences. 14. Fine: cloudy: clear with sharp frost. 15. Hazy frosty. 16. Slight rain. frosty. 17. Slight snow: clear and frosty. 18. Frosty: clear: snow. 19 Sharp frost: uniformly overcast: clear and frosty. 20 Cloudy: snowing. 21. Sharp frost: frosty haze. 22. Snowing: hazy 23. Snowing: overcast. 24. Overcast: frosty. 25 Fine frosty. 26. Hazy. 27 Foggy. fine frosty. 28 Overcast. 29. Snow showers. 30. Snowing. 31. Overcast: windy: drifting snow.

Mean temperature of the month	33°·45
Mean temperature of Jan. 1854	37 88
Mean temperature of Jan. for the last twenty-nine years ...	37 ·06
Average amount of rain in Jan.	1·74 inch.

Boston.—Jan. 1. Cloudy: stormy. 2. Cloudy. 3. Fine. 4—9. Cloudy. 10. Fine. 11, 12. Cloudy. 13. Cloudy: rain P.M. 14—16. Cloudy. 17. Cloudy: snow A.M. 18—20. Cloudy. 21, 22. Cloudy snow A.M and P.M. 23 Cloudy: snow A.M. 24—26. Cloudy. 27. Fine. 28. Cloudy. 29. Fine. snow P.M. 30, 31. Cloudy.

Sandwick Manse, Orkney—Jan. 1. Sleet-showers A.M. snow-showers, frost P.M. 2. Cloudy A.M. fog P.M. 3. Drizzle A.M drizzle, showers P.M. 4. Bright A.M.: rain P.M. 5. Showers A.M.: showers, thunder and lightning P.M. 6. Showers, bright A.M.: showers, thunder and lightning P.M. 7. Drops A.M.: drizzle P.M. 8. Rain A.M. and P.M. 9. Clear A.M and P.M. 10. Clear, frost A.M.: rain P.M. 11. Drizzle A.M. cloudy P.M. 12. Cloudy A.M. and P.M. 13. Cloudy, fine A.M.: fog P.M. 14, 15 Cloudy A.M. and P.M. 16. Showers, bright A.M.: cloudy P.M. 17. Clear, frost A.M.: fine, rain P.M. 18. Frost, showers A.M.: damp P.M. 19. Drizzle A.M.: drizzle, showers P.M. 20. Damp, fine A.M.: fine, clear P.M. 21. Cloudy A.M.: fine, cloudy P.M. 22. Showers A.M.: sleet P.M. 23. Bright, frost A.M.: clear, frost P.M. 24. Bright, frost A.M. fine, frost P.M. 25. Cloudy A.M.: rain P.M. 26. Cloudy A.M.: snow-showers P.M. 27. Bright, frost A.M.: snow-showers P.M. 28. Snow-showers A.M. and P.M. 29—31. Snow, clear A.M.: frost, clear P.M.

Mean temperature of Jan. for twenty-eight previous years ...	38°·38
Mean temperature of this month	38 ·16
Mean temperature of Jan. 1854	36 ·46
Average quantity of rain in Jan. for fourteen previous years .	4·38 inches.

Meteorological Observations made by Mr. Thompson *at the Garden of the Horticultural Society at* CHISWICK, *near London*; *by* Mr. Veall, *at* BOSTON; *and by the* Rev. C. Clouston, *at Sandwick Manse*, ORKNEY.

Days of Month.	Barometer.					Thermometer.					Wind.			Rain.		
	Chiswick.		Boston. 8¾ a.m.	Orkney, Sandwick.		Chiswick		Boston. 8¾ a.m.	Orkney, Sandwick		Chiswick. 1 p.m.	Boston.	Orkney, Sandwick.	Chiswick.	Boston.	Orkney, Sandwick.
1855. Jan.	Max.	Min.		9¼ a.m.	8¼ p.m.	Max.	Min		9¼ a.m	8¼ p m						
1.	29·951	29·919	29·44	29·31	29·73	53	46	52	36½	34½	w.	wnw	nw.	·02	....	·37
2.	30·069	30·028	29·72	29·88	29·88	51	44	43	36	39	nw.	nw.	sw.	·01	......	·02
○ 3.	30·170	30·139	29·74	29·83	29·79	52	39	44	46	46½	nw.	wnw	sw.	....	....	·11
4.	30·218	30·164	29·72	29·65	29·40	47	38	37	48	48½	sw.	w.	sw.	...	....	....
5.	30·132	30·062	29·66	29·52	29·35	51	40	46	40½	42	sw.	sw.	w.	......	....	·40
6.	30·361	30·240	29·81	29·88	30·01	50	44	48	40½	43	sw.	calm	s.	....	.....	·27
7.	30·530	30·428	30·00	29·86	29·99	49	42	45	48	46½	sw	calm.	sw.	....	......	·20
8.	30·464	30·303	30·00	29·77	29·78	48	41	45	47½	41½	sw.	w.	nw.	......	......	·48
9.	30·405	30·283	29·83	30·15	30·38	50	28	45	37	38	w.	wnw.	w.	02	....	·36
10.	30·525	30·495	30·20	30·36	30·28	39	27	28	36	39½	ne.	wnw	s	....	....	....
☾ 11.	30·525	30·457	30·16	30·19	30·44	38	29	35	48	41½	ne.	sw.	nw	.....	....	·09
12.	30·543	30·519	30·22	30·55	30·58	41	32	32	41½	41½	ne.	nw	wnw	......	....	....
13.	30·536	30·432	30·22	30·54	30·51	42	26	34	43½	34	ne.	nw.	e	....	....	....
14.	30·468	30·434	30·15	30·47	30·47	41	19	33	43	43	ne	n.	w.	....	·03	....
15.	30·456	30·223	30·08	30·34	30·31	35	21	34	44	38	w	nw.	n.	......	.....	·21
16.	30·081	30·017	29·77	30·28	30·35	40	22	35	37	38	n.	nw.	ne.	·01	......	·08
17.	30·077	30·011	29·90	30·44	30·36	32	20	28	35	38	ne.	ene.	nw.	....	....	....
● 18.	30·118	29·955	29·87	30·23	30·19	34	18	28·5	39	44	ne.	nnw.	n.	....	·03	·06
19.	29·984	29·879	29·73	30·15	30·14	28	13	28	42	40	se.	calm	nne.	....	....	·04
20.	29·839	29·702	29·70	30·17	30·16	31	18	30	38½	37	ne.	ene.	e.	....	....	·02
21.	29·841	29·724	29·65	30·12	30·11	34	17	29	37	37	ne.	s.	e.	.....	....	....
22.	29·803	29·762	29·50	29·97	29·91	35	18	30	38	35	sw.	nw.	se.	.....	·20	·10
23.	29·868	29·807	29·64	29·95	30·15	34	24	31	36	34	n.	n.	s.	.....	·08	·06
24.	30·003	30·000	29·77	30·23	30·26	37	26	34	35	34	ne.	n.	se.	....	·05	....
☽ 25.	30·023	29·991	29·77	30·18	29·98	38	23	33	38	37	nw.	n	sw.	04	....	....
26.	30·003	29·871	29·66	30·02	30·12	37	17	32	33	34	sw.	nw.	ene.	....	....	·15
27.	29·972	29·946	29·70	30·22	30·12	34	15	23·5	36	36	ne.	nw.	nw	....	....	·02
28.	29·934	29·847	29·66	29·88	29·85	36	26	32	33	35	nw.	nw.	calm	......	....	·09
29.	29·730	29·597	29·45	29·84	29·83	35	17	23	28	29	nw	n.	ne.	....	....	·07
30.	29·718	29·669	29·54	29·85	29·90	33	25	30	29	30	ne	e.	ese.	....	·04	·06
31.	29·498	29·425	29·40	29·92	29·97	31	23	28·5	28	31	ne.	e.	w.	....	....	....
Mean.	30·124	30·043	29·79	30·056	30·074	39·87	27·03	34·7	38·08	38·25				0·10	0·43	3·26

THE ANNALS

AND

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[SECOND SERIES.]

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XXI.—*A Comparative View of the more important Stages of Development of some of the higher* Cryptogamia *and the* Phanerogamia. By CHARLES JENNER *.

FOR some time past, the few hours of leisure I have been able to spare from the pressing engagements of business, have been employed in investigating the germination and reproduction of the higher Cryptogamic plants; those Cryptogamic plants in which sexual organs have been recognized, and the reproductive spores of which, at one or other stage of their development, are enclosed in a testa or case. My attention was early directed to the following facts:—

First. That in different orders of these plants, the spores are enclosed in their testæ, and set free from their connexion with the parent plant, at altogether different stages of development. For example,—

The vesicular spore of a Moss is fecundated before it obtains an enveloping case and is set free; whereas the spore of a Fern, when it is detached, consists only of a vegetative axile cell, which developes into a thallus upon which is borne the fecundating organ as well as the archegonial cell. And

Secondly. That very varying stages of development are arrived at, within the enclosure of the spore-case, in the several orders of the higher Cryptogams: thus—

In Ferns, the spore developes only externally to the spore-case the cellular frond which bears the archegonial cells, whereas in the *Selaginella* the analogous cellular expansion is developed within the spore-case.

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* Read before the Botanical Society of Edinburgh, March 8, 1855.

It thus became apparent to me at the very outset of my investigations, that in considering the question of the entire cycle of an individual life among these plants, we should never lose sight of the fact, that there is no such identity among the spores of the higher Cryptogams, as is supposed to exist among the embryogenic seeds of Phanerogams; and also, that we should err as much in assuming the spore, at the period of its vegetative development, to represent the earliest stage in this cycle, as we should, were we to consider the seed as the first stage of the existence of a Phanerogamous plant, overlooking the origin and development of the embryo, its envelopes and its albumen, and the special relation which these latter bear to the parent plant.

All plants above the lowest possess special cellular structures, within which, as within the ovular envelopes, or in the substance of which, as in the pro-embryo of a Fern, there is produced an embryonal chamber or sac. In the interior of this cell the protoplasm or formative matter is concentrated, from which is evolved the whole after-structure. Thus, in Mosses, in Lycopodals, and in Ferns, as well as in Phanerogamous plants, it is a single cell within which the subsequent development is called forth through the influence of fecundation. This germ-cell is in every case the commencement of the new individual cycle of life.

To enable me to trace, as carefully as I propose, the analogy between the principal organs and stages of development of the higher Cryptogamic plants and the Phanerogamic, I must ask you to dissociate in your minds this germinal vesicle from the structure within which it has its origin. These investing organs are very varied in their form and texture. The most striking differences prevail between them in Gymnospermous plants and Angiospermous plants, and also between them in the orders and even genera of Angiosperms and the several orders of Cryptogams; while, on the other hand, there is an approach to homogeneity in the form, structure, and early general development of the germ-vesicle itself, so that unless we dissever, as it were, this germ-vesicle from those heterogeneous environments (which have only for their purpose the sustentation and preservation of the germ-vesicle), we shall trammel our subject with unnecessary difficulty and fail to attain that clear point of view that is so desirable.

There are thus then certain structures, so intimately associated with the germ-vesicle of all but the lowest plants, though totally independent of it, that we can scarcely investigate the course of the one without to some extent entering upon the consideration of the nature and relation of the other. These structures may be called accessory or investing organs, and as examples of them I may mention, the various coats of the ovule, the pro-embryonic frond of Ferns, and the cellular layer which environs the embryonal germ of a Moss, and which afterwards constitutes the spore-case. I may repeat that these investing organs belong to the organic structure of the parent plant; and they do so belong to it, whether they are maintained in their connexion with it, as are the primine and secundine of the ovule, or whether they are disconnected from it, as is the prothallus of a Fern. The first growth therefore to be recognized as independent development, is the vesicular coat which is formed around the concentration of protoplasmic or germinative matter within the embryo-sac. The contents of this vesicle are the immediate resultant of the parent life, the first formative act of the new existence being the cell-wall enclosing these contents. In the unimpregnated stage of the germinal vesicle, its derived power has become isolated, for its processes of assimilation and the varying disposition of the protoplasm must be considered acts of its separate vitality.

I have further to notice generally, that in all plants the separation of the young plant from the old,—of the newly-derived existence from the parent life, is accompanied by a condition of rest, or rather of the capability of resting; for instance, the Phanerogamous embryo within its testa, the vesicle of a Cryptogam within its spore-case.

This resting stage is always carefully arranged for by the provision of suitable integuments and store of endospermous matter. We have seen that the resting stage is attained at varying epochs of development in different orders of plants, and that a more or less amount of development is attained within the particular receptacle of the parent plant. Special organs are modified to suit the special circumstances of each case. Thus, in Angiospermous Phanerogams, for sustentative and nutritive purposes, the coats of the ovule are maintained in their connexion with the axis by means of a funicular cord; whereas the homologous organ of Filices—a free development subsequent to the resting stage—is cellular fibrillæ or rootlets. These fibrillæ of the prothallus of the Fern are, however, not only homologous with the funiculus of the ovule of Angiospermous Phanerogams, but their function is the same, namely that of affording support and nutriment. The funiculus of the ovule then, and the fibrillæ of the prothallus of the Fern, are, to speak briefly, homologous and analogous organs.

I now proceed to my particular purpose, which is to trace in a general manner the cycle of development of a Moss, a Fern, a Phanerogamous plant, and to trace in outline a few analogies between their more important organs, which, if diverse in appearance and without any very apparent relation, have at least common purposes. Nature is so infinitely varied in her forms of manifestation, and she is so rich in her adaptation of means, yet withal has such a clear and palpable unity of purpose, that on the one hand we need not be surprised at apparent discrepancies, and on the other we need never doubt one common identity.

In the Table (p. 246) I have separated the investing organs from the germinal body, and have shown the relation which I hold the various organs of the plants under review have to each other, and also distinguished the stage of development in each order at which the resting condition is attained; this condition being in every case precursory of detachment from the parent plant. The investing organs may be divided into general and special; the general investing organ being the ovarium in Angiospermous Phanerogams, the theca in Filices, and the archegonium (in its ripened condition the sporangium) in Musci. The special investing organs are those which immediately environ the germinal vesicle; these are, in the Phanerogamia the coats of the ovule, in Filices the pro-embryo, and in Musci the sporular integument which enfolds the nucleal germ, and which finally constitutes the testa of the Moss-spore. The unimpregnated germinal vesicle of the Phanerogamia finds its homologue in the archegonial cell of the pro-embryo of the Fern, and in the embryonal cell within the archegonium of a Moss. The maturation of this cell is only preparative to the fecundative act, or the fertilizing process, whatever that may be, which takes place, in one or other manner not yet determined, in all plants at this stage of progress. The impregnating influence or matter being imparted to this vesicle, embryonal development ensues, and always in the same general manner, varied only by the special varying circumstances of each particular case. The fertilized cell stands on the verge of the active development of an independent vitality. In Ferns the resting stage is passed before impregnation has taken place. The course of growth after impregnation is continuous. The germinal body, by a succession of transverse divisions, obtains the condition of a septate cellular process, longitudinal and radial divisions follow, and a structure is formed which developes an ascending and descending axis, in due course to disengage from the former a bud, the commencement of a new cycle of individual life.

In Phanerogamia, immediately after fertilization, which I need not say takes place within the ovarium, a transverse septum is formed across and within the germinal vesicle; by successive transverse divisions of the superior half of this germ-cell, a confervoid filament is formed, which has received the name of the suspensor. The suspensor varies in length in different families, orders and genera, being longer in some and shorter in others, but in all it is distinctly a septate cellular process. The inferior moiety of the germ-cell, by a series of longitudinal, transverse, and radial divisions, developes into a radicular portion and a cotyledonary expansion, and only when this stage is reached do the outer coats of the investing organs become more or less dense by intra-cellular deposit. Detachment takes place at the hilum, and the embryo enclosed in its case becomes free as a "*seed.*" This is the resting stage in Phanerogamia. In Mosses, the germ being fertilized, its outer envelope or cellular investment becomes dense and firm, and no further development takes place within the general investing organ. The spore has attained the resting stage and is set free. The fertilized vesicle, now the spore, is no sooner placed in circumstances favourable for development, than dehiscence of the outer envelope takes place, the embryonal cell protrudes and elongates, transverse septa are formed, as in the case of the Phanerogamic germ-vesicle, a branched confervoid filament or septate cellular process is developed, which I submit is the homologue of the suspensor, and from a cell of this filament arises the phyllary axis, which bears in its turn the reproductive organ, and thus completes the cycle.

I do not pretend to offer this as a thoroughly proven exposition of the subject. I lay it rather before you somewhat in the shape of an hypothesis. Yet, if, after carefully weighing the subject, I had not felt it to be supported by observation, I should not have occupied the valuable time of this Meeting. No one can be more sensible of the incompleteness of this my first essay than myself. I am too truly a tyro in science to deem that I can teach. I can only venture to hope that I have touched chords of thought, that in abler and more skilful hands may evolve knowledge. Truth is so valuable, and opinion, unless accordant with truth, so worthless, that while I solicit your kind consideration even to the errors of my essay, I invite your free and candid criticism.

COMPARATIVE TABLE.

MUSCI.	PHANEROGAMIA.	FILICES.
ARCHEGONIUM OR SPORANGIUM.	OVARIUM.	SPORANGIUM OR THECA.
Nucleal Germ.	Placental Bud.	Axile Bud or Spore. RESTIN STAGE
Sporular Envelope.	Ovular Envelopes. = { *Primine.* *Secundine.* *Embryo-sac.*	Pro-Embryo
Embryonal Cell.	Germinal Vesicle.	Archegonial Cell.
FECUNDATION.	FECUNDATION.	FECUNDATION.
Fertilized Embryonal Cell or Spore. RESTING STAGE.	Fertilized Germinal Vesicle.	Fertilized Archegonial Cell.
Confervoid pro-Embryo.	Confervoid Suspensor	Septate Cellular Process
Plumular Bud.	Radicle. Plumule. RESTING STAGE.	Radicle. Plumular Bud.
Phyllary Axis.	Phyllary Axis.	Phyllary Axis.

DESCRIPTIVE TABLE.

	MUSCI.	PHANEROGAMIA.	FILICES.
GENERAL INVESTING ORGAN.	Archegonium or Sporangium.	Ovarium.	Sporangium or Theca.
SPECIAL INVESTING ORGAN.	Sporular Membrane.	Ovular Envelopes. Primine. Secundine. Embryo-sac.	Pro-Embryo
GERMINAL BODY.	Embryonal Cell.	Germinal Vesicle.	Archegonial Cell.

XXII.—*Observations on the Natural History and Habits of the Common Prawn,* Palæmon serratus. By Robert Warington, Esq.

Having during the years 1852 and 1853 had the opportunity of making some observations on the natural habits and minute characteristics of the common prawn, *Palæmon serratus*, which I understand are novel, I have been induced to collect the results together and submit them to the readers of this Journal.

The observations about to be detailed were made in the small tanks or aquaria already described*, in which the balance between the animal and vegetable organisms in a medium of sea water was permanently maintained without artificial aëration or disturbance. The materials employed for effecting this, in the aquarium now under consideration, consisted of the *Ulva latissima* and *Enteromorpha* as the vegetable members of the circle; several varieties of *Actinia*, *Madrepora*, *Annelida*, and *Palæmon*, to represent the animal section; while the functions of the scavengering mollusks were fulfilled by *Littorina*, *Trochus* and *Purpura*. The small tank, containing these several organized members, was constructed of a zinc framing 3 feet in length, one foot in depth and one foot in breadth, having the bottom, ends and back filled with slate, and the front, or part towards the observer, glazed with plate-glass, the whole being covered over loosely by a shade partially glazed, so as to impede the evaporation of the water, exclude as much as possible the soot and dust of the London atmosphere, while, at the same time, a continual change of air could take place. A quantity of rock-work was also introduced, and so arranged that the creatures could readily find a retreat, or screen themselves from the strong influence of the sun's rays during the day, and from the numbing effects of radiation in a clear night. A short and small shingle beach was also constructed at one extremity of the aquarium, to enable the various denizens to retreat to shallow water whenever they should be so inclined.

Into this vessel, thus arranged, several individuals of the common prawn were introduced during the months of October and November 1852; they were fed every second or third day with small pieces of either oyster, mussel, cockle, shrimp, and the like, or, when these could not be obtained, with softened shreds of raw, lean meat which had been previously dried by exposure to the air in order to preserve it from putrefaction, and allow of its being kept as a store of provision capable of being had recourse to as occasion might require.

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* Transactions of the Chemical Society, as published in their Quarterly Journal, vol. iii. p. 52, 1850; Garden Companion, January 1852; Annals and Mag. Nat. Hist. vol. x. p. 273, and vol. xii. p. 319.

The manner in which these beautiful creatures take their food while foraging about the tank is very interesting. The first and second pair of didactylous feet are cautiously and continuously thrust into every cranny, around and partially under the pebbles and rock-work, and often into the tubes of *Serpulæ* or *Sabellæ*, or the shells of the univalve mollusks and others; and these, if not protected by an operculum or some provision for closing the orifice of their tube or shell, soon fall a prey to their attacks. When anything edible is met with, it is rapidly seized by these prehensile feet and transferred to the jaws.

The senses of touch and smell in the *Palæmonidæ* are exceedingly delicate, the latter appearing to reside most strongly in the antennæ. Thus, when a small particle of food has been dropped into the water and has sunk to the bottom, the moment the antennæ of the prawn in its movements pass across the column of water through which the food has fallen, the whole motion of the creature becomes changed in an instant, and it darts rapidly here and there, from the surface throughout the path of its transit until it is discovered; and often, after it has been devoured by the one, a second prawn will, on reaching the same locality, gain the scent and hunt over every spot in search of that which has been already removed, but which evidently had left its track of odour behind. It has very often occurred, that if some one of the *Actiniæ* had been first fed, the *Palæmon*, on gaining the scent, has tracked the food to the *Actinia* and speedily rifled it of its repast; and, in instances where the latter had even transferred its meal by means of its tentacula to its pouch, the prawn has redoubled its efforts, and frequently dragged the savoury morsel out of its very stomach. This operation it effects in a very surprising manner: the *Palæmon* charges, without any apparent fear, full on the extended disk of the *Actinia*, the tentacula of which it keeps in constant play by means of its three pairs of unarmed feet, while, at the same time, one of the second or larger pair of prehensile feet is thrust into the orifice of its maw, and the food forcibly and quickly extracted. The only chance the poor *Actinia* has of preventing this and securing its feast, appears to be by contracting the whole of its tentacula together, and thus forming itself into a small globular form, so as to close entirely all approach to the orifice of its stomach. The energy with which this attack is effected depends very much on the keenness of the prawn's appetite, and, in cases where the *Actinia* is strong and also very hungry, the conflict is often very severe, and the aggression is sometimes, though rarely, successfully repelled.

The first pair of didactylous feet are slender and most delicate in their structure, and, when examined with a magnifying glass, are found to be provided at their extremities with a brush-like appendage of short hairs standing out at right angles to the claw. The power of motion with which these are endued is most wonderful, and their usefulness is applied in every conceivable direction,—around the eyes, and among the apparently complicated apparatus of mandibles, antennæ and palpi, at the head, within or beneath the carapace, and for some distance between it and the body, particularly when the period of moulting is approaching; also for the cleansing of the abdominal false feet or swimming webs and the expanded lobes of the tail: and the appearance of the prawn during the execution of the brushing or scrubbing operation at these more distant parts is grotesque in the extreme, the body is supported and raised high on the four pair of legs, the abdominal part and tail being curved forward between them, so that the whole posterior division of the creature can be brought within the reach of the first pair of feet, and thus the necessary cleansing operation be readily effected.

When in full swimming action, the appearance of these beautifully transparent creatures is most elegant. The front feet are generally laid backward and tucked under the body like the fore legs of the deer tribe in the act of leaping; the long and delicate antennæ stream gracefully on each side of its body, and float for some distance beyond its entire length, while its strong abdominal paddles propel it rapidly through the water. In the aquarium under consideration, the whole of these elegant creatures were in the habit, on the summer evenings, of careering to and fro for upwards of an hour's duration, close to the glass front of the case and towards the room, presenting a most pleasing object, and one which must be observed in order to be appreciated, as no description can convey an adequate idea of the interesting scene.

It is also a curious and striking phænomenon to observe these *Palæmonidæ* by the aid of a lighted candle or lamp in a dark room during the night, in consequence of the bright reflection of the luminous body from their prominent pedunculated eyes; and as the prawn does not retain a stationary position, but slowly roams about through the water and over the rock-work seeking for its food, it adds an increased interest to the appearance, to behold these small globes of bright light, like the bull's-eye signal lamps of a miniature railway engine looming through the distance in a dark night, moving slowly along, the body of the creature being quite imperceptible, and nothing visible but these pairs of globular balls of fire shining from out the dark water. Even the small eyes of an allied species, that remarkable little crustacean, the *Athanas nitescens*, exhibit the same effect, although from their shy habits and diminutive size it can be but rarely observed.

When the period arrives at which the *Palæmon serratus* is about to throw off its old external covering, it ceases to feed, and seeks about from spot to spot in a restless and fidgetty manner, until it has fixed on a locality apparently sufficiently adapted for the purpose required and suited to its fancy; for this really appears at times to be the case. The third, fourth and fifth pairs of legs are then stretched out wide apart, and the feet hooked so as to hold firmly upon the surrounding substances, in such a way that the body may be poised and capable of moving freely in all directions, as though suspended on gimbals. The prawn then slowly sways itself to and fro, and from side to side, with strong muscular efforts, apparently for the purpose of loosening the whole surface of the body from the carapace; the two pair of prehensile or didactylous legs are at the same time kept raised from the ground, stretched forwards, and frequently passed over each other with a rubbing motion, as if to destroy any remaining adhesion; the eyes also may be observed to be moved within their covering by muscular contraction from side to side; and when every precaution appears to have been perfectly taken for the withdrawal of its body from its too limited habiliments, a fissure is observed to take place, between the carapace and the abdomen at the upper and back part, and the head, antennæ, legs, feet and all their appendages, are slowly and carefully drawn backward and out from the dorsal shield until the eyes are quite clear of the body-shell or carapace, and appear above the upper margin of it; the prawn thus half released then makes a sudden backward spring or jerk, and the whole of the exuvium is left behind, generally adhering by the shell of the six feet to the surface it had selected for its purpose.

A moment's consideration will develope to the contemplative mind what a truly wondrous process this act of exuviation really is. When we reflect on the small size of this crustacean, and the extreme delicacy and intricacy of its various organs, and then find that in this moulting, the shell of the most minute and complicated of these structures is thrown off in a complete and unruptured state, even to the gauze-like membrane covering the projecting and pedicled eye, the filamentous antennæ, the many-jointed legs, the delicate didactylous hand, the paddled abdomen with its beautiful appendages, the palpi, and all the minute spines and microscopic hairs with which these various members are provided,—the human mind can hardly appreciate the wonderful wisdom of the Creative power that could have called into existence so marvellous an adaptation.

At the moment the prawn has been thus liberated from its old envelope, it rolls on the surface of the ground perfectly helpless, for it is at first, evidently, so soft, that it does not possess the power of supporting its own weight erect upon its feet, while the beautifully delicate antennæ float from its head like gossamer threads through the water. In a short time however it plunges or springs, by a strong muscular exertion of the abdomen, from place to place, stretches its webbed tail and the large paddles of its swimming apparatus, and soon retreats into some dark and sheltered corner, where it remains, continually exercising its various organs, until such a period as the new investing membrane shall have become sufficiently hardened to allow of its venturing forth among its companions without danger, for during all this interval it is liable to their attacks whenever it comes near them, and is obliged by a series of forcible leaps rapidly to evade their attempts and escape out of their way. When the newly coated *Palæmon* first makes its exit from its hiding-place, its appearance is doubly beautiful; the colours are so clear and bright, particularly the orange and rich brown bands which encircle the pale blue prehensile feet, the various markings are so defined, and the small spines and fringes of hair so clean and well developed, and the deportment of the creature itself is altogether so bold and vainglorious, as though proud of its new vesture, that it cannot but command the admiration it seems to seek.

It may be interesting to specify here the intervals of this moulting as they were observed during the summer of 1853. These periods were ascertained in the following manner. When the observations first commenced there were eight healthy prawns in the aquarium, and as each exuvium was cast off it was removed from the water and the date noted down, and by continuing this process the following results were obtained :—

May 25th, two cast skins were removed.
,, 29th, two ,, ,,
,, 31st, one ,, ,,
June 5th, one ,, ,,
,, 7th, two ,, ,,
,, 9th, two ,, ,,
,, 12th, two ,, ,,
,, 14th, two ,, ,,
,, 16th, one ,, ,,
,, 19th, one ,, ,,
,, 21st, one ,, ,,
,, 26th, one ,, ,,
,, 27th, one ,, ,,
,, 28th, one ,, ,,

June 29th, one cast skin was removed.
July 4th, one " "
" 9th, one " "
" 11th, one " "

At this date four individuals were given to a friend, so that the number was reduced to four.

July 15th, one cast skin was removed.
" 17th, one " "
" 18th, one " "
" 21st, one " "
" 30th, one " "
August 3rd, one " "
" 4th, two " "
" 12th, one of the prawns died during the moulting.
" 14th, one cast skin was removed from the aquarium.
" 21st, one " " "
September 2nd, one " " "

So that the period appears to vary from twelve to twenty-four days. This variation may depend upon the quantity of food taken by the respective individuals, and also on the varying temperature of the aquarium, which, from its small capacity and other circumstances, is very liable to be readily affected by the heat of the sun through the day, and the effects of radiation during a clear night. I may mention that if these cast skins are not removed from the water, the prawns will devour all the smaller and softer parts, as the legs, the palpi, and the false or swimming feet, with great rapidity.

I hope in a future communication to add several observations on other varieties of the *Palæmonidæ*.

Apothecaries' Hall, Blackfriars, March 12, 1855.

XXIII.—*Report on a Collection of* Diatomaceæ *made in the District of Braemar by* Professor Balfour *and* Mr. George Lawson. By R. K. Greville, LL.D. &c.*

[With a Plate.]

In the course of the autumn of last year, Professor Balfour made a botanical excursion with a small party of friends and pupils to the mountainous district of Braemar; and his attention having been directed for some time past to the Diatomaceæ, he, and Mr. George Lawson made a considerable number of gatherings in a great variety of situations, from the patches of snow which even in summer are always to be found in certain nooks and corners of Ben-na-Muic-Dhui, down to the valleys of the Dee, Glen Callater and Glen Tilt. The gatherings were subsequently placed in my hands, with a request that I would examine and report upon them to the Botanical Society. I have accordingly submitted the collections to a patient investigation, and in now presenting my account of them, I have to acknowledge the kind assistance of the Rev. William Smith, Professor of Natural History in the Cork College, to whom I referred the new and dubious forms as the individual most competent to give an authoritative decision in such cases.

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* Read before the Botanical Society of Edinburgh, Feb. 8, 1855.

The following is a general list of the species collected, which, although not so extensive as might have been anticipated, is rich in rare and interesting forms. The new species, and those recently or for the first time added to the British flora, are printed in *italics*.

Epithemia turgida (*Ehr.*).
—— alpestris, *W. Sm.*
—— rupestris, *W. Sm.*
—— gibba (*Ehr.*).
Eunotia Arcus (*Ehr.*).
—— incisa, *Greg.*
—— gracilis, *W. Sm.*
—— monodon, *Ehr.*
—— diodon, *Ehr.*, three forms.
—— *Camelus*, Ehr.
—— triodon, *Ehr.*, two forms.
—— *tridentula*, Ehr.
—— tetraodon, *Ehr.*
—— *quaternaria*, Ehr.
Cymbella cuspidata, *Kutz.*
—— affinis, *Kutz.*
—— *ventricosa*, Kütz.
—— Scotica, *W. Sm.*
—— Helvetica, *Kütz.*
—— *lunata*, W. Sm., nov. sp.
—— *æqualis*, W. Sm., nov. sp.
Amphora ovalis, *Kutz.*
Cocconeis Pediculus, *Ehr.*
Cyclotella operculata, *Kütz.*
Surirella linearis, *W. Sm.*
—— biseriata, *Bréb.*
Cymatopleura Solea (*Kütz.*).
Navicula *cocconeiformis*, Greg., nov. sp.
—— rhomboides, *Ehr.*
—— crassinervia, *Bréb.*
—— serians, *Kütz.*
—— firma, *Kütz.*
—— ovalis, *W. Sm.*
—— angustata, *W. Sm.*
—— gibberula, *Kütz.*
—— cryptocephala, *Kütz.*
Pinnularia major (*Kütz.*).
—— viridis (*Ehr.*).
—— *hemiptera*, Bréb.
—— acuminata, *W. Sm.*
—— lata (*Bréb.*).
—— alpina, *W. Sm.*
—— late-striata, *Greg.*
—— radiosa (*Kutz.*).
—— acuta, *W. Sm.*
—— tenuis, *Greg.*
—— divergens, *W. Sm.*
—— stauroneiformis, *W. Sm.*
Stauroneis Phœnicenteron (*Ehr.*).
—— gracilis, *Ehr.*
—— anceps, *Ehr.*
Synedra lunaris, *Ehr.*
—— radians, *W. Sm.*, with vars. β. and γ.
Cocconema lanceolatum, *Ehr.*
—— cymbiforme, *Ehr.*
—— Cistula, *Ehr.*
Gomphonema acuminatum, *Ehr.*, with var. γ.
—— dichotomum, *Kutz.*
—— tenellum, *W. Sm.*
—— capitatum, *Ehr.*, with var. β.
—— olivaceum (*Lyngb.*).
—— intricatum, *Kutz.*
Meridion circulare, *Ag.*
—— constrictum, *Ralfs.*
Himantidium Arcus, *Ehr.*
—— majus, *W. Sm.*
—— pectinale (*Dillw.*).
—— undulatum, *W. Sm.*
Odontidium hyemale (*Lyngb.*).
—— mesodon (*Ehr.*).
—— *anomalum*, W. Sm., nov. sp.

Odontidium Tabellaria, *W. Sm.*
—— ? *Harrisonii*, var. *β*, W. Sm.
Denticula tenuis, *Kütz.*
—— obtusa (*Lyngb.*).
—— sinuata, *W. Sm.*
Fragilaria virescens, *Ralfs.*
Achnanthidium flexellum, *Breb.*
—— lanceolatum, *Bréb.*
Diatoma tenue (*Ag*).
Diatomella Balfouriana, W. Sm., nov. gen.
Tabellaria flocculosa (*Roth*).
—— fenestrata (*Lyngb.*).
Melosira nivalis, *W. Sm.*
—— *distans*, Kutz.
Orthosira *spinosa*, W. Sm., nov. sp.
—— orichalcea (*Mert.*).

I shall now proceed to notice the new species and a few others of novelty or rarity.

Eunotia Camelus, Ehr.? Pl. IX. fig. 1. Length ·0009″.

This is recorded in Kützing's 'Species Algarum,' published in 1849, as a native of the two widely separated localities, Cayenne and Labrador. It occurred in a recent state in one of the Braemar gatherings, and has been observed by Professor Gregory in others from Carr Bridge and Ben Nevis, and by Professor Walker-Arnott in one from Fell End, Lancashire. I have likewise seen it fossil, but very rarely, in Lapland Bergmehl. This diatom, in the opinion of the Rev. Professor Smith, is certainly the *E. Camelus* of Ehrenberg and Kützing, notwithstanding the inaccurate figure given by the latter, in which the base of the frustule is represented as concave. In the form under consideration the base is so remarkably straight, that it is difficult to conceive how an artist could have made such an error in its delineation. Professor Gregory, moreover, informs me that he has seen in the Mull deposit a form exactly corresponding with Kützing's figure; so that it is possible that two species may have been confounded together. Under these circumstances I consider it advisable to refer our diatom doubtfully to *E. Camelus*, and to add a figure for the guidance of the student. I have unfortunately no access to Ehrenberg's illustration (Amer. t. 2).

Eunotia tridentula, Ehr. Pl. IX. fig. 2. Length ·0005″.

Found along with the preceding. It belongs to a little group of minute, linear forms, quite distinct from the more robust and convex series having the same number of undulations. The only station given by Kützing for this species is America. Dr. Gregory has observed it in a great variety of gatherings from Banffshire; Carr Bridge, Morayshire; from the Findhorn and from Ben Nevis. Professor Smith obtained it also last year at a high elevation in Auvergne. It is probably therefore of general distribution.

Eunotia quaternaria, Ehr. Pl. IX. fig. 3. Length ·0007″.

A species scarcely to be distinguished from the last, except by the additional tooth or undulation. Cayenne is the only locality recorded by Kützing, but, like the preceding, it has probably escaped notice on account of its minuteness. Since I detected it along with *E. tridentula* in one of the Braemar gatherings, Professor Gregory has observed it in those from Carr Bridge and Ben Nevis. Dr. Walker-Arnott has also met with it, and it is in Professor Smith's list from Auvergne. In this form, as well as in *E. tridentula*, the base is slightly concave, and there is a small undulation near each end.

Eunotia incisa, Greg. Length ·0008″.

First observed and well figured by Professor Gregory in his account of the rich fossil diatomaceous earth of Mull, published in the 'Journal of Microscopical Science.' He has since found it in various recent gatherings; in fact, it appears to be very generally diffused throughout the alpine districts of this country. It is of frequent occurrence in the Braemar gatherings. I have likewise seen it in fossil deposits from the United States. Professor Smith, I believe, entertains some doubts whether this diatom be a genuine *Eunotia*; and it must be confessed that it has much the aspect of a *Himantidium*, bearing a close resemblance in form to *H. Veneris*, Kütz., as Professor Gregory has remarked. Kutzing however admits it as a new species, and as the striation is that of a *Eunotia*, I feel disposed to retain it as such. Although not strictly speaking a novelty, I refer to it in this place chiefly in order to correct a slightly erroneous view regarding the outline. In examining the frustule under a power of three or four hundred diameters, there does appear to be an incision or notch near each extremity of the frustule; hence the specific name. But on the application of higher powers the apparent notch is found to be a deception caused by the nodule and a slight contraction, commencing at the nodule and continued to the apex. It is, in fact, the nodule interrupting the marginal continuity of the frustule, which causes the appearance of an incision. I find among living specimens quite as extensive a range of form as is represented by Professor Gregory in the paper above referred to.

Cymbella æqualis, W. Sm. Pl. IX. fig. 4. Length ·0014″.

A very distinct new species, so nearly symmetrical as to be liable at a hasty glance to be taken for a *Navicula*. There is however a curve at the shortly produced, obtuse extremities. The striæ are fine, but not very close. This form was abundant in one gathering only, composed of coarse black peaty mud extremely difficult to clean.

Cymbella lunata, W. Sm. Pl. IX. fig. 5. Length ·0013″.

Another new species, about the same size as the last, but the striæ are much stronger and more distant, and the shape narrow and elongated. The larger segment of the valve has a gentle and equal curve, while the smaller segment is nearly straight, a character sufficient of itself to distinguish it from the larger *C. Helvetica*, which is ventricose. From *C. Scotica* it is separated by the coarse striæ and the obtuse ends.

Navicula cocconeiformis, Greg. MS. Pl. IX. fig 6.
Length ·0008″ to ·0011″.

Navicula nugax, W. Sm. MSS.

A new species, somewhat similar in outline to *Achnanthidium flexellum*, with striæ so fine that I have not succeeded in resolving them. I find that this species has been known for above a year to Professor Gregory, who had both sketched and named it previous to my detection of it in the Braemar gatherings. He had obtained it from Elchies and various other places in Banffshire, and latterly from Loch Leven.

Pinnularia hemiptera, Bréb.

This species, found, as Professor Smith informs me, not unfrequently since the first volume of his work was published, I met with almost pure near the Pass of Killiecrankie early last summer. It was obtained by squeezing the moisture out of *Sphagnum*, and along with it occurred an undescribed species, *Pinnularia gracillima*, Greg. MSS. In the autumn I again found it in the mountainous district of Redesdale in Northumberland, by resorting to the same process, and singular enough, *P. gracillima* was there also, with scarcely any intermixture of other diatoms. *P. hemiptera* greatly resembles *P. viridis*, but is distinguished from it by the much finer striæ, and perhaps also by a more strictly linear outline. It was scarce in the Braemar gatherings, and unaccompanied by *P. gracillima*.

Pinnularia late-striata, described by Professor Gregory from the Mull deposit, and found recent by Professor Smith in Grassmere, is scattered through a number of the Braemar gatherings, generally associated with other of the alpine *Pinnulariæ*, as *P. lata*, *P. alpina*, *P. divergens*, &c. Though not plentiful anywhere, it seems to be generally diffused. Professor Gregory informs me that it occurs in more than half of the very numerous Scottish gatherings which he has examined. Professor Smith likewise found it in Auvergne.

Odontidium anomalum, W. Sm. Pl. IX. fig. 7–9.

Odontidium anomalum, W. Sm., Ann. of Nat. Hist. vol. xv. p. 7. pl. 1. fig. 8.

A new and very interesting diatom, discovered last summer by Professor Smith in the Cevennes at an elevation of about 4000 feet, and by Professor Balfour and Mr. Lawson in Braemar immediately afterwards. It was exceedingly scarce, and mixed with *Melosira distans*, Kütz. This species is described and figured by Smith in his paper on the Diatomaceæ of the South of France, recently published in the 'Annals of Natural History.' Its chief character rests on the linear valves, constricted towards the obtuse extremities; but the very peculiar structure of the valves as seen in the front view affords besides a most conspicuous distinction. This structure arises from the presence of "internal cells," which Professor Smith regards as an abnormal condition of the filament, because frustules of the more usual description (as occurring in other species) may be occasionally found side by side with others containing internal cells. Theoretically, this view may be correct; but it is certain that in the only specimens hitherto observed in France and Scotland, the filaments are almost exclusively composed of frustules containing the internal cells, and which thence derive a most marked character, while the normal frustules are, as Professor Smith justly remarks, rarely to be detected. It would be a very curious fact if this diatom should prove to be known everywhere in an abnormal condition—and that that condition should be one of increased development. This so-called abnormal structure—which according to my view differs considerably from that exhibited in the figure which illustrates Professor Smith's paper—is very beautiful under the microscope. Each frustule in the figure referred to contains an internal cell, elliptical or linear-elliptical (as the filaments happen to vary in breadth from ·0006″ to ·0015″), converging to a point at each end, and traversed longitudinally by a median line. The following, on the contrary, is the result of my own observations, made, I may add, before I saw Professor Smith's paper. When a frustule becomes abnormal it is divided by an elliptically curved line, the centre of the curve approaching very close to the lateral margin, while the extremities of the line terminate nearly in the middle of each end of the frustule. On each side of the termination of the line are situated the minute nodules which are present in every condition of the diatom. A single frustule is thus subdivided into two cells, as will be more readily perceived by referring to the figures. The same arrangement precisely, takes place in the adjoining frustule, only the direction of the line is reversed; so that when the two frustules are viewed in connexion, the lines form a symmetrical elliptical figure truncated at each end, for they are very far from converging to a point. The median line of the "internal cell," represented by Professor Smith's artist, is in fact the junction of two frustules. A somewhat similar arrangement appears to exist in *Meridion Zinckeni*, Kütz.*, as far as I can judge from the figures given by the author, for I have not had an opportunity of examining specimens myself.

Among the interesting acquisitions made during the excursion, the first place must unquestionably be given to a very minute form discovered in both Glen Callater and Canlochlan, but extremely rare. Judging from the general character of the frustules, Professor Smith was inclined to think that they belonged to a filamentous species, but being unfortunately all in a scattered state, he could not with any certainty assign its place in the system. He therefore, with some doubt, bestowed upon it the provisional name of *Grammatophora? Balfouriana*. Having had occasion to examine this most remarkable diatom minutely in the preparation of this report, I have come to the conclusion that Professor Smith is correct in referring it to one of the filamentous groups. My reasons for coinciding in this view are— 1. That, apart from the peculiar structure, which of itself is almost sufficient evidence, there is a greater variation in the relative length and breadth of the frustules than would be likely to occur in other diatomaceous groups. In some the length is more than equal to twice the breadth, while others are exactly square, and between these two extremes every gradation may be observed; resembling in this inequality, *Fragilaria, Odontidium, Grammatophora*, and other filamentous genera having plano-compressed frustules. 2. Two nodules exist at each extremity of the frustule, as in *Odontidium, Fragilaria*, &c.

With reference to the genus of this diatom I have ventured to take a more decided course, as it does not appear to me that it can be regarded even doubtfully as a *Grammatophora* without doing violence to that genus. The vittæ in the frustules of *Grammatophora* are, to borrow a portion of Kützing's definition, "medio interruptæ, plus minusve curvatæ;" they are, in fact, with the exception of this interruption, continuous throughout; whereas in the form under consideration they are as much interrupted at each end as they are in the middle, and are besides not in the slightest degree curved. Two internal septa run through the frustule, as in *Grammatophora*, and upon these the so-called vittæ are developed, but which, from the causes above mentioned, are so much abbreviated as to resemble elongated coloured nodules; for in the shorter frustules their form becomes merely oblong or even oval. Unquestionably there is an evident affinity with *Grammatophora*; but upon the whole, seeing that, besides the differences already referred to, all the known species of the last-named genus are marine, I hope it will not be considered as a rash proceeding if I propose to establish a new genus for the reception of this curious freshwater diatom.

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* Professor Gregory informs me that this diatom was pointed out to him by De Brébisson in a gathering made by me last summer at Duddingston Loch. I had not observed it myself, and Dr. Gregory's slide containing it is not at the present moment accessible. Dr. Gregory has since observed it in some Banffshire gatherings.

DIATOMELLA, nob.

Frustules quadrangular (forming at first a plano-compressed filament, at length separating). Coloured vittæ two, straight, interrupted in the middle and at each end. Length 0004″ to ·0010″.

Diatomella Balfouriana. Pl IX. fig. 10–13

Grammatophora? Balfouriana, W Sm. MSS.

The general characters of this minute species are visible without difficulty under a magnifying power of 400 or 500 diameters. The frustule is surrounded by a thickened border, and is divided into three more or less equal parts by two straight internal septa or bars not clearly defined externally, on each of which, at about equal distances between the middle and ends, are situated two dark-coloured short vittæ, while at the ends themselves the septa terminate in minute nodules In the most elongated frustules the coloured vittæ are linear, but they contract in proportion as the frustules diminish in length, until they lose the character of vittæ and resemble nodules. The middle portion of the frustule is blank, while the spaces between the septa and the margin are transversely striated, but it requires a power of at least 600 diameters to bring this character out. The frustules of this diatom are not unfrequently seen in the process of self-division, and one of these I have represented in the plate. It will be perceived that a narrow separation has already taken place, and that in each portion the lateral striæ are apparent, while as yet there is only one septum. The next stage in the process would probably be the division of the single septum into two, followed by the development of the blank middle space.

Melosira nivalis, W. Sm.

A new species previously determined by Professor Smith, and which will appear in the forthcoming second volume of his work.

I am not aware of the original station. It is scattered through two or three of the Braemar gatherings, and I found it near the Pass of Killiecrankie last summer. Professor Smith is, I believe, under an impression that *Coscinodiscus minor* may turn out to be the sporangial form of this species.

Melosira distans, Kütz.

I was not aware of this diatom having been previously collected in this country, until Professor Gregory recently informed me that he had noticed it in a gathering from Elgin, as well as in some other collections from the north of Scotland, but believing that it was already known as a British species, he had not drawn attention to it. The gathering placed in my hands is remarkably pure, and agrees exactly with slides in my possession from Bilin and Habichtswald, stations given by Kutzing. Professor Smith found it also in Auvergne. It is much to be regretted that a note of the precise locality of this diatom was not preserved, as it is the only station for the rare *Odontidium anomalum*, which was found intermixed with it.

Orthosira spinosa, W. Sm. Pl. IX. fig. 14–17.

Orthosira spinosa, W. Sm., Ann. of Nat. Hist. vol. xv. p. 8. pl. 1. fig. 12.

This is another instance of the all but simultaneous discovery of a new species by Professor Smith in France, and Professor Balfour in Scotland. It was collected by the former on Mont Dore, at an elevation of 4236 feet; by the latter in a locality where it would be produced under a corresponding temperature, if we take into consideration the difference of latitude. The structure of this plant is very interesting. The outer wall of the cylindrical filament is continuous, but separates spontaneously at the junction of the valves, where the inner wall contracts in a rounded manner. The valve is here beautifully striated, the striæ being coloured and semi-opake at the junction, but soon becoming colourless, and gradually disappearing in the transparent tissue of the valve. When the orifice of the valve is examined, it is found to be closed by a concave diaphragm marked with radiating striæ, coloured at the circumference and pale and moniliform as they approach the centre, where there are usually three or four minute perforations. The peculiar character of the species lies, according to Professor Smith, in the valves or frustules being furnished at the point of junction with a fringe of spine-like processes; but I confess that I have been unable to make out this character to my satisfaction. I have indeed occasionally thought that I perceived a fringe which reminded me of the peristome of some Mosses, but on a closer inspection it disappeared; and what seemed to be extraordinary, I could not find the spines when I sought for them in the position most favourable for their exhibition, viz. when viewing the valve vertically or in profile. The point then to be ascertained, seems to be the structure at the boundary line, where the valvular striæ terminate at the orifice, and those of the diaphragm commence. And I need not say, that it is with great deference that I venture to take a different view from so high an authority as Professor Smith, and to suggest that the appearance of spines may have been caused by an optical deception. It seems to me, after reiterated examinations with both low and high powers, that the valvular striæ simply curve round towards the edge of the orifice to meet those of the diaphragm. The striæ (or vittæ as they might well be called), being coloured and conspicuous, and the tissue of the valve very pellucid, do present, when viewed in certain lights and in certain directions, the semblance of short processes. In the view I have now given of the structure of the valve at the point of junction, I may however be in error, and I hope that other observers will endeavour to determine the question The filaments of this species vary in diameter from ·0007″ to ·0015″.

EXPLANATION OF PLATE IX

Fig 1 *Eunotia Camelus?* The lower figure represents an unusually depressed form
Fig 2 *Eunotia tridentula*
Fig. 3. *Eunotia quaternaria*
Fig. 4. *Cymbella æqualis*.
Fig 5. *Cymbella lunata*.
Fig. 6. *Navicula cocconeiformis*. This and all the above as seen under a power of 600 diameters.
Fig 7 Portion of a filament of *Odontidium anomalum*
Fig. 8 Three frustules separated, but otherwise in their relative position. Magnified 400 diameters.
Fig 9. A single frustule more highly magnified.
Fig. 10. Frustules of *Diatomella Balfouriana*; magnified 400 diameters.
Fig. 11. A frustule of the average proportion.
Fig. 12. Frustule in the process of self-division.
Fig. 13. Side view of frustule. Figs. 11–13 as seen under a power of 1000 diameters.
Fig. 14. Portion of filament of *Orthosira spinosa*; magnified 300 diameters.
Fig. 15. Portion of filament showing the character of the striation, &c.
Fig. 16. The diaphragm as seen vertically.
Fig. 17 Orifice of valve with marginal striation, closed by the diaphragm.

XXIV.—*On Fossil Echinoderms from the Island of Malta; with Notes on the stratigraphical distribution of the Fossil Organisms in the Maltese beds.* By THOMAS WRIGHT, M.D. &c., Professor of the Natural Sciences in the Cheltenham Grammar School.

[Concluded from p. 196.]

Genus SCHIZASTER (Agassiz, 1834).

Urchins with a cordiform test, broad and depressed before, narrow and elevated behind; the ambulacral summit excentral and nearer the posterior border; the petaloid ambulacra lodged in very deep depressions, the antero-lateral much longer than the postero-lateral pair; the single ambulacrum long and deeply sunken in the anteal sulcus; the peripetal fasciole surrounds the ambulacral star, and from one of the antero-lateral angles thereof, a second postero-lateral fasciole arises, which passes downwards and backwards along the sides and under the anus, where it joins its fellow of the opposite side, the genital pores are two in number from the fusion of the anterior and posterior pairs; the five ocular plates are small and lodged in depressions, the eye-holes are microscopic. *Schizaster* differs from *Hemiaster* in possessing a postero-lateral fasciole, and in having the antero-lateral ambulacra less divergent and lodged in deeper depressions, the anteal sulcus is also much deeper.

Schizaster eurynotus, Agassiz.

SYN. *Echinus Spatangus compressus et lapidescens in Melitensi topho*, Scilla, Corp. Mar. tab. 7. fig. 1.

Echinus gladiatus vestitus et nudus Imperati, Klein, Echinod. p. 35. tab. 27 A.

Spatangus lacunosus, Leske, no. 77. p. 227.

Spatangus canaliferus, Lamarck, Anim. sans. Vert. 2nd ed. tom. iii. p. 327; Grateloup, Foss. Ours. Dax, p. 67.

Schizaster eurynotus, Sismonda, Mem. Echin. Foss. Nizza, tab. 2. fig. 3. p. 31; Agassiz and Desor, Ann. Sc. Nat. tom. viii. p. 21. série 3.

Spatangus Scillæ, Desmoulins, Etudes sur les Echin. no. 24. p. 392.

Test heart-shaped, depressed and rounded anteriorly, elevated and pointed posteriorly; ambulacral areas deeply excavated; the single ambulacrum long, deep, wider in the middle and narrower at the anterior border, which is deeply grooved by it; antero-laterals slightly *f*-shaped; angle 52°; length $1\frac{5}{20}$ inch: postero-laterals, angle 72°, short, $\frac{7}{10}$ths of an inch; apical disc with two genital holes near the posterior third;

single interambulacrum elevated into a prominent carina terminating in a caudal hooked process.

Description.—This Urchin resembles *Schizaster canaliferus* now living on the shores of the Mediterranean, and for which it has been mistaken by some naturalists, but an attentive study of the living and fossil species discloses characters by which they may be distinguished from each other. The test in *S. eurynotus* is cordate, depressed before and elevated behind. The ambulacral areas are deeply depressed; the odd or anterior ambulacrum is nearly twice the width of the pairs, it swells out in the middle, is blunted at the apex, and most contracted at the anteal sulcus, which is deep and narrow when contrasted with the width it attains above. The poriferous zones lie at the base of the walls of the sulcus; the very narrow plates that compose the floor of this area are each studded with a row of small granules. The antero-lateral ambulacra diverge at an angle of 52°; they are slightly *ſ*-shaped, and are $1\frac{5}{20}$ inch in length: the numbers of holes in the zones are thirty-six and thirty-four. The postero-lateral pair are short, and make an angle of 72°; they are $\frac{7}{10}$ths of an inch in length, and have respectively twenty-six and twenty-four holes in their zones. The peripetal fasciole passes close to the base of the posterior pair, dips slightly into the space which separates the anterior from the posterior pair, runs at some distance from the anterior pair, passes close by the base thereof obliquely towards the anteal sulcus, into which it dips, and meets its fellow from the opposite side: the very narrow postero-lateral fasciole is directed obliquely downwards and backwards, and unites with its fellow at some distance below the anus. The test is depressed anteriorly and sloped away at the cheeks, whilst behind it is much elevated. The interambulacrum forms an elevated ridge between the posterior ambulacral pair, and is produced into a caudal-like process behind, beneath which the circular anus is pierced; the sternal portion of the odd interambulacrum is tumid and convex; the basal portions of the lateral and anterior pairs slope gently towards it; the tracks of the ambulacra are nearly naked as they approach the mouth, and are here perforated with buccal pores. The mouth is at the anterior third, and has a projecting underlip; the tubercles on the upper surface are small and of a uniform size; those on the sternum are larger, and are perforated and set on crenulated summits; they are arranged in lines radiating from a posteal point; the tubercles of the interambulacral pairs are the largest.

Affinities and differences.—This species very much resembles the living *S. canaliferus*, but it may be distinguished from it by the following characters:—*S. eurynotus* is broader and more depressed before, and is not proportionally so high behind as *S. canaliferus*; the antero-lateral ambulacra are more divergent, and the postero-lateral pair are proportionally longer in *S. eurynotus* than in *S. canaliferus*. The single ambulacrum is about the same depth as the pairs, and has the pores in a single file in *S. eurynotus*, whereas in *S. canaliferus* this area is much deeper, and the pores are not in single file, but are crowded together, so that they form three rows in a part of the zone, the tubercles of the base are much larger in the living than in the fossil species. *S. eurynotus* is distinguished from *S. Parkinsoni* by its *f*-shaped ambulacra being less divergent, and the position of the apical disc, which is much nearer the posterior border in *S. eurynotus*; the anterior ambulacrum is likewise much wider and deeper in that Urchin than in *S. Parkinsoni*: the great development of the single interambulacrum, and breadth of the posterior border in *S. Desori* sufficiently mark that species as widely distinct from *S. eurynotus*.

Locality and position.—Collected in bed No. 4, the calcareous sandstone at Malta; we have it also from Santa Manza, Corsica, sent us by M. Michelin; it has likewise been found in the Ter. moyen de Perpignan, Cagliari.

Schizaster Desori, Wright, n. sp. Pl. VI. fig. 3 *a–c*.

Test cordate, broad and much depressed before, narrow and much elevated behind; ambulacral areas long, straight, and very divergent, peripetal fasciole forms an acute angle on the anterior interambulacra, apical disc situated at the posterior third of the dorsum; angle of the antero-lateral ambulacra 44°; angle of the postero-lateral pair 60°; posterior border truncated obliquely downwards and inwards; sternal portion of the interambulacrum tumid and prominent at the base, amounting almost to a deformity.

Dimensions.—Antero-posterior diameter $2\frac{8}{10}$ inches, transverse diameter $2\frac{7}{10}$ inches, height at the deepest part $1\frac{8}{10}$ inch.

Description.—This remarkable Urchin wants the symmetrical proportions of the other Schizasters met with in the same rocks; it is rounded and broad before, and tapers into a narrow wedge-shape process behind; the dorsal surface inclines forwards at an angle of 17°; the ambulacral areas are long. The single anterior area compared with *S. eurynotus* is narrow, and of a uniform width; it is $1\frac{5}{10}$ inch in length from the apical disc to the fasciole; there are twenty-four pairs of pores in the avenues, the external being much larger than the internal row, although this is properly speaking a generic character. The antero-lateral ambulacra diverge nearly straight outwards at an angle of 44°, they form deep depressions in the test $1\frac{3}{10}$ inch in length, and the zones contain thirty pairs of holes in each: the postero-laterals are slightly petaloid, and gently flexed outwards; they are $\frac{15}{20}$ths of an inch in length, and diverge at an angle of 60°. The zones contain about twenty pairs of holes; the test being nearly as broad as it is long across the termination of the antero-lateral ambulacra; the anterior border is gently rounded, and has a rather deep anteal sulcus for the ambulacrum, from the same point to the posterior extremity it tapers suddenly, which gives a wedge-shaped appearance to the test when viewed from above. The most remarkable feature in this Urchin is the curious form which the single interambulacrum assumes, owing to the great development of this area; the dorsal surface forms an inclined plane having an inclination of 17°; the anterior part is therefore very much depressed, and the posterior part much elevated. The single interambulacrum forms a prominent beak-like process, beneath which the posterior border is broad, and inclined downwards and forwards; the sternal portion of this area is prominent and convex, towards which the basal parts of the lateral interambulacra slope suddenly forwards and inwards. The anus is pyriform, and placed high up underneath the beak-like process The mouth is situated near the anterior border; it has a large under-lip, but is crushed in the small specimen, and covered up in all the others before us The small apical disc lies concealed at the posterior third of the dorsum by the prominent apices of the lateral interambulacra. The peripetal fasciole takes a zigzag course along the outer borders of the ambulacra, and from the base of the antero-laterals it passes nearly at right angles across the anterior interambulacra to the external side of the single ambulacrum, where it makes another angle, then passes down the side thereof $\frac{3}{10}$ths of an inch, dips into the sulcus and unites with the opposite fasciole. The lateral fasciole commences at the angle near the base of the antero-lateral ambulacra, and passes downwards and backwards nearly in a straight line over the angle of the posterior border at some distance from the anus, and meets the one from the opposite side, at the middle line near the base; in the triangle thus formed, the caudal process and anus occupy the base, and a depression lies beneath which is filled with tubercles somewhat larger than those on the dorsum, but smaller than those on the base; the tubercles are perforated and raised on prominent crenulated bosses (fig. 3 *c*); the sternal and basal portions of the test, as well as the anterior border, being furnished with much larger tubercles.

Affinities and differences.—The straightness of the pairs of ambulacra, and the narrowness of the single anterior ambulacrum, are alone sufficient to distinguish *S. Desori* from *S. eurynotus* when viewed only from above, but when we add to these the remarkable oblique truncation of the posterior border (fig. 3 *b*), the great tumidity of the sternum, and the sloping character of the sides of the base, we discover how widely different these two forms are from each other. The same group of characters serves to distinguish it from *S. Parkinsoni*, but in this species the apical disc is much nearer the centre of the test; the antero-lateral ambulacra are arched outwards, and the postero-laterals are proportionately longer.

Locality and stratigraphical position.—Collected from the calcareous sandstone bed No. 4, at Malta; the large specimen belongs to the Bristol Institution, the others form part of Earl Ducie's collection. We dedicate this species to M Desor of Neufchâtel, one of the learned authors of the 'Catalogue raisonné des Echinides.'

Schizaster Parkinsoni, Defrance sp. Pl. V. fig 3 *a–c*.

SYN. *Spatangus Parkinsoni*, Defrance, Dict. Sc. Nat. tom. 50 p 96, Desmoulins, Etudes sur les Echinides, p. 394. no. 29.

Spatangus lacunosus, Parkinson, Organic Remains, vol. iii. tab. 3. fig. 12.

Schizaster Parkinsoni, Agassiz and Desor, Cat. raisonné, Ann. Sc. Nat. tom. viii. p. 22.

Test cordate, depressed anteriorly, elevated posteriorly; apical disc nearly central; sides expanded and tumid; cheeks sloping and contracted; single ambulacrum rather wider than the anterior pair, of the same diameter throughout, except near the apex; antero-lateral ambulacra diverge at an angle of 35°; length 1 inch, postero-lateral make an angle of 65°; length $\frac{6}{10}$ths of an inch; posterior part of the back raised into a long prominent carina; posterior border obliquely truncated; base convex; mouth near the anterior border; anteal sulcus narrow and of moderate depth.

Dimensions.—*Adult.* Antero-posterior diameter $2\frac{13}{20}$ inches, transverse diameter $2\frac{11}{20}$ inches, height $1\frac{13}{20}$ inch.

Junior. Antero-posterior diameter 2 inches, transverse diameter $1\frac{9}{10}$ inch, height $1\frac{3}{10}$ inch.

Description.— We have identified this Urchin with that figured by Parkinson in his 'Organic Remains,' not however without much hesitation, inasmuch as that figure is without details, and is moreover drawn from a distorted specimen. We have in vain endeavoured to find out the original, and have therefore, from the central position of the apical disc and the great divergence of the ambulacra, and from its being at the same time the most common of all the Maltese Schizasters, and the one most likely to have been sent to Parkinson, adopted Defrance's identification. The test is heart-shaped, its widest part being at a line drawn across the disc; from this imaginary line the back slopes obliquely forwards, and the border is rather bevelled away at the cheeks; from the same line backwards there rises a prominent ridge which bends over into a short tail-like process. The ambulacral areas (3 *a*) are deeply sunken, the single ambulacrum has a tapering lanceolate form, and the anteal sulcus is deep and narrow; the poriferous zones lie in the angle of the depression; they consist of twenty-five pairs of holes, of which the outer series is the largest; the length of the petaloidal portion of this area from the apex to the fasciole is $1\frac{1}{20}$ inch. The antero-lateral ambulacra (3 *a*) are more divergent in this species than in the other Schizasters met with in the same rocks, they are $1\frac{1}{20}$ inch in length and are slightly curved outwards and backwards; they make an angle of 35°, the number of pores (3 *c*) in the zones is respectively thirty-six and thirty-four, the apical eight pairs being almost microscopic: the postero-lateral pair are $\frac{6}{10}$ths of an inch in length and slightly *ſ*-shaped; they are directed backwards at an angle of 65°, and are proportionately narrower than the anterior pair, there are twenty-two pairs of holes in each of the zones, the upper six pairs of which are microscopic. The peripetal fasciole (3 *b*) is distinctly defined and passes close to the bases of the petaloid portions of the ambulacra, but at a short distance from the sides thereof it describes a curve inwards in passing over the anterior interambulacra, and dips obliquely into the anteal sulcus where it unites with that of the opposite side. The lateral fasciole is large and very distinct; it takes a backward and downward course towards the base of the posterior border, and joins its fellow at some distance below the anus; the two fascioles form the letter V in their *trajet* on the test. The apical disc is situated very near the centre of the back, removed a little nearer to the posterior than the anterior border; it is perforated with four equal-sized genital holes. The anus is oblong, situated high up in the obliquely truncated posterior border, in which is a triangular depression limited on the sides by the fasciole, and above by the anal opening and caudal process; the base is convex; the sternum is not very prominent, and has lines of tubercles proceeding in radii from a point near the border; the basal portions of the posterior ambulacra are naked, and around the mouth buccal pores are seen which extend at considerable intervals along the *trajet* of the posterior pair. The mouth is situated in the anterior fourth of the base and has a projecting under-lip; the basal parts of the interambulacra glide into the general convexity of the floor of the test; the lateral pair have a regular tuberculation, but on the anterior pair the tubercles are larger and more irregular.

Affinities and differences.—The nearly central position of the apical disc and the greater divergence of the antero-lateral ambulacra distinguish this Urchin from its congeners; the narrowness of the odd ambulacrum and the absence of the swelling-out in the centre of the same, serve to separate it from *S. eurynotus*; the blunt caudal process, the small posterior border, and the general tumidity of the sides distinguish it from *S. Desori.*

Locality and stratigraphical position.—Collected from bed No. 4, the calcareous sandstone at Malta, where it is common, it is found likewise in the Molasse, middle tertiaries, of Martigues, Bouches-du-Rhone. Fine specimens are contained in the British Museum, Jermyn Street Museum, and that of the Bristol Institution.

Since the preceding sheets of this memoir have been passing through the press, we have had the opportunity of examining the Maltese fossils belonging to the Geological Society, and some that had escaped our notice in the British Museum collection; from these new materials the following notes are now added.—

Clypeaster Reidii, Wright, n. sp.

Test large, broadly pentagonal, and much elevated, border abrupt, margin thin and undulated, rising with steep sides at angles of 60°, and with a very little curve towards the vertex, which is nearly central; petaloidal portions of the ambulacral areas large, nearly equal in width, and extending over nearly three-fourths of the sides; base quite flat; mouth small, pentagonal, nearly central: basal ambulacral sulci proceeding from the angles of the mouth, narrow, and sharply defined; anus round, near the posterior margin; tubercles on the upper surface small and closely set together, those on the base a little larger; apical disc nearly central and prominent, with an outer circle of genital holes, and an inner circle of eye-holes having the madreporiform tubercle in the centre.

Dimensions.—Antero-posterior diameter $5\frac{6}{10}$ inches, transverse diameter $5\frac{2}{10}$ inches, height $2\frac{8}{10}$ inches.

Description.—This large *Clypeaster* has been mistaken for one of the varieties of *C. altus*, but a careful study of its test discloses characters by which it is readily distinguished from that common form. The circumference is nearly pentagonal; it is rounded before, undulated on the sides, and nearly straight behind; the sides of the pentagon are of unequal length, those forming the front of the test are the shortest, those of the middle are somewhat longer, and the posterior single side is the longest. There is scarcely any margin to the test in this species, as the sides rise abruptly from the border to the apex, making angles of 60° with the base, and being only slightly curved inwards, the dorsum is therefore very small in proportion to the diameter of the base. The petaloidal portions of the ambulacral areas extend over nearly three-fourths of the sides; they form long elegantly-shaped petals, narrower in proportion to their length than those of *C. altus*, and consequently allowing of a greater development of the interambulacral areas than in that species; the petaloidal ambulacral areas are nearly all of the same length, width and structure; the centre of each petal is arched and costated, and forms a considerable relief on the surface of the test. The poriferous zones lie in slight depressions on their sides, each zone contains sixty-two pairs of pores set widely apart; in the inner row the holes are round, in the outer row they are oblong, and both are united by straight oblique sulci; the external surface of the partition-wall between each pair is covered with a row of small tubercles. The bases of the ambulacra are open, but not so widely as in some other congeneric forms. The interambulacral areas are nearly flat, of moderate width, and very uniform in their structure. The apical disc occupies the centre of the dorsal surface; it consists of two circles of holes; the outer is formed of five small genital holes, the plates of which are not distinguishable, and the inner of five small perforated ocular plates, which are distinctly visible at the apices of the ambulacra. The madreporiform tubercle occupies the centre, and forms a button-like prominence there; the border is thin and undulated, and this portion of the test presents a striking difference to the obtuse marginal fold seen in *C. altus*. The base is quite flat; the pentagonal mouth is small and nearly central; the oral lobes are curved inwards at an acute angle, and the five ambulacral sulci are sharply defined as they radiate from the sides of the pentagon to the border. The anus is round, and is situated near the posterior border. the tubercles on the upper surface are small and closely set together; those on the base are a little larger.

Affinities and differences.—*Clypeaster Reidii* very much resembles *C. umbrella* both as to height, width, and the smallness of its tubercles; it is distinguished from that species by the following characters. *C. Reidii* is more elongated; the petaloidal ambulacra are longer and narrower; the interambulacra are flattened and slightly curved, the base is quite flat, and the oral lobes are curved acutely inwards. In *C. umbrella* the interambulacra are arched and costated, the base is concave, and the oral lobes slope obliquely inwards. Compared with *C. altus*, the differences are found to be still greater: in *C. Reidii* the test is broader in proportion to its length; the petaloid ambulacra are narrower; the poriferous zones are not so open at the base. The apical disc is convex and prominent in *C. Reidii*, and depressed in *C. altus*. In *C. Reidii* the border is thin and sharp, and the base is flat. In *C. altus* the border is thick and rounded, and the base is concave. In *C. Reidii* the mouth is small, and the oral lobes curve acutely inwards; whilst in *C. altus* the large mouth lies at the bottom of a concave depression formed by the gradual inward sloping of the interambulacra. The distinctions between our species and that of *C. scutellatus* and *C. marginatus* are so well defined, that it is unnecessary to make a comparison with them.

Locality and stratigraphical position.—This species is apparently from bed No. 1, the Gozo marble, but this we cannot with certainty state. Fine specimens are in the Jermyn Street Museum, and in the collection of the Geological Society of London. We dedicate this species to his Excellency Sir William Reid, Governor of Malta, whose laudable efforts to form a public collection of Maltese fossils have greatly contributed to our knowledge of the palæontology of the island.

Genus PYGORHYNCHUS, Agassiz, 1839.

In the dismemberment of the genus *Nucleolites* of Lamarck, M. Agassiz has not been so fortunate as in other groups of *Echinida* the characters on which, for example, *Catopygus* and *Pygorhynchus* are distinguished from *Nucleolites* are not satisfactory, as they undergo important modifications in the different species grouped together in each of these new genera. If we take a type specimen of each genus only and compare them together, we admit the distinctions pointed out; but when we examine several species of each of these genera, we observe the characters gradually blending into the primary type form: as representatives *in time*, the grouping is valuable, but the zoological characters in our judgment are too indefinite to found genera thereon. With these remarks we refer provisionally the small Nucleolite before us to the section *Pygorhynchus*, which is thus characterized by Agassiz:—"Form elongated; ambulacra distinctly petaloid, often costated as in *Echinolampas*. Mouth central or subcentral, pentagonal, surrounded with five large lobes, and a distinct rosette of buccal pores. Anus posterior, nearer the superior than the inferior border." All the species of the genus *Pygorhynchus* belong to the nummulitic and tertiary rocks; those of the genus *Catopygus*, with one exception, are cretaceous forms.

Pygorhynchus Vassalli, Wright, n. sp.

Test oblong, wider behind than before; interambulacrum produced into a caudal elongation; petaloid portions of the ambulacral areas narrow and short; sides tumid; anus small, round, nearer the inferior border than the dorsum, with a projecting beak-like process arching over its upper border, and an oblique truncature of the lower part of the border below; base slightly concave; mouth pentagonal, nearly central; oral lobes small; rays of the poriferous star around the margin short.

Dimensions.—Antero-posterior diameter 1 $\frac{3}{20}$ inch, transverse diameter $\frac{7}{10}$ths of an inch, height nearly $\frac{6}{10}$ths of an inch. Most of the specimens average only from one-half to two-thirds of these dimensions. The large specimen before us is the most perfect we have examined.

Description.—This small Urchin has an oblong form, it is rounded before, a little enlarged towards the junction of the middle with the posterior third, which is produced into a caudal process. The sides are tumid, and the upper surface is flattened; the petaloid portions of the ambulacral areas are narrow and short, and form only a star on the dorsum; the single and postero-lateral areas are nearly alike in width and length; the antero-lateral pair are rather wider and shorter, they are $\frac{7}{20}$ths of an inch in length, and are slightly curved forwards and outwards, their poriferous zones contain eighteen pairs of pores, arranged in narrow rows, and not united by any apparent slit. The postero-lateral areas are $\frac{8}{20}$ths of an inch in length, and their zones contain twenty pairs of pores; these areas are directed much backwards, which makes the width of the lateral interambulacra proportionally greater. The apical disc is nearly central, but nearer the anterior border; it has four large genital pores, and five well-marked eye-holes. The single ambulacrum is almost identical in length and width with the posterior pair, the apices of all the ambulacra are rather rounded than lanceolate The lateral interambulacra we have said are very wide, but the single interambulacrum is narrow, and forms a conspicuous prolongation or beak-like process, which arches over the upper border of the round anal opening, situated rather below the middle of the posterior border, in an oblique truncature of the test: this beak-like process is not seen in the small specimens before us; it would therefore appear to be a character of the adult condition only. The base is slightly concave towards the mouth, which is situated nearer the anterior border; it has a pentagonal form, with five small oral lobes covered with tubercles; between them, the terminations of the ambulacra form five short poriferous petals. The tubercles on the upper surface are small and irregularly disposed on the plates; those on the base are a little larger, especially in the vicinity of the mouth.

Affinities and differences.—This species resembles *Catopygus fenestratus* from the upper chalk of Ciply, Belgium, but is distinguished from it by having the sides more tumid and the upper surface flatter, the posterior border is likewise more produced; it distinctly differs from it however in having the base slightly concavé, and the oral lobes less developed. It differs from *Nucleolites* (*Pygorhynchus*) *subcarinatus*, Goldf., from the middle tertiaries of Bunde, in having more tumid sides, a less concave base, and a different form of the anal opening. From the very brief notice of *Catopygus conformis*, Desor, from the tertiaries of Orglande, it is impossible to form any idea how far it may resemble that form, as it is neither figured nor described, but merely entered in the 'Catalogue raisonné' with this remark: "Mais l'anus est un peu plus bas, et la face supérieure plus surbaissée."

Locality and stratigraphical position.—Collected from bed No. 1, Malta, where it is extremely rare. Specimens are in the collection of the Geological Society, the Jermyn Street Museum, and the cabinet of Earl Ducie. We dedicate this species to Dr. Vassallo of Malta, under whose judicious care and continued research the public collection of Maltese fossils has been greatly enriched.

Spatangus Desmarestii, Goldf.

SYN. *Spatangus Desmarestii*, Goldf. Petref. p. 153. tab. 47. fig. 4 *a–c*; Agassiz and Desor, Cat. raisonné, Ann. Sc. Nat. tom. viii. p. 7.

Test cordate, arched and carinated; anteal sulcus broad; petaloid portion of the antero-lateral ambulacra long, narrow, and curved outwards and a little backwards, angle of inclination 18°; postero-laterals long and narrow, angle 60°, only a few moderate-sized tubercles on the interambulacral plates between *all* the ambulacral areas, border slightly obtuse; posterior part truncated; anal opening transversely oblong; base plano-convex; tubercles moderate in size; mouth transversely oblong, situated at the junction of the anterior with the middle third; tubercles on the upper surface very small.

Dimensions.—A German type specimen. Antero-posterior diameter $2\frac{7}{10}$ inches, transverse diameter $2\frac{6}{10}$ inches, height $1\frac{6}{10}$ inch.

A Maltese specimen. Antero-posterior diameter $1\frac{8}{10}$ inch, transverse diameter $1\frac{7}{10}$ inch, height $\frac{17}{20}$ths of an inch.

Description.—This Urchin is well known from the admirable figure in Goldfuss. Its upper surface is more convex and inflated than in the other congeneric species; it is higher behind than before, and has a blunt ridge which passes backwards from the disc to the border. The antero-lateral petaloidal ambulacra, $\frac{12}{20}$ths of an inch in length, curve a little outwards, forming an angle of 18°; their zones contain from twenty-two to twenty-four pairs of pores, separated by rather thick partitions of the test. The postero-lateral areas are narrower than the anterior pair, and rather more than an inch in length; their zones contain from twenty-eight to thirty pairs of holes, and they form angles of 60°. The interambulacral areas are wide and largely developed in this species; the upper plates in these areas, lying between the ambulacra, support only very small perforated tubercles, arranged in groups of threes and fours, and disposed on all the areas; this character serves to distinguish *S. Desmarestii* from all its congeners at present known the small tubercles on the dorsal surface are very small, and closely set together. The single ambulacrum is lodged in a broad shallow valley, which forms however a considerable anteal sulcus; the pores in this area are so much covered up with matrix in our specimen, that we are unable to count their number. The posterior border is truncated, and the large transversely oval anal opening occupies the upper part of this region. The shelly matrix entirely conceals the course of the subanal fasciole. The sternal portion of the interambulacrum is slightly convex, and covered with small tubercles that radiate in lines in all directions from a central point; the basal portions of the anterior and lateral interambulacra are covered with larger tubercles, and the naked intermediate spaces indicate the *trajet* of the basal portions of the postero-lateral ambulacra from the border to the mouth. The mouth is situated at the junction of the anterior with the middle third; it is much elongated transversely, and has five poriferous petals surrounding it. The apical disc is small and nearly central; it has four genital holes and five small eye-holes.

Affinities and differences.—The inflation of the test, the smallness of the large tubercles on the upper surface, and their presence on the interambulacrum, serve to distinguish this species from its congeners.

Locality and stratigraphical position.—Found with *S. Hofmanni* in bed No. 4, the calcareous sandstone at Malta, where it is rare. The Maltese specimens we have seen are small, and do not exceed the dimensions given; they are contained in the collections of the British Museum and the Geological Society. In Germany it is found in the middle tertiaries at "Duberge bei Bünde, and at Astrupp bei Osnabrück." The admirable figure given by Goldfuss of this species is all that can be desired.

Genus Eupatagus, Agassiz, 1847.

Spatangoid Urchins, with a cordate or elliptical form, more or less depressed; the petaloid portions of the antero- and postero-lateral ambulacral areas are wide; the single area is lodged in a shallow anteal sulcus, and the entire ambulacral star is closely surrounded by a broad well-defined peripetal fasciole, which undulates round its margin; within this fasciolar space, the interambulacral plates carry very large perforated tubercles raised on crenulated bosses, and surrounded by wide smooth areolas, like those in the genus *Spatangus*. The heart-shaped shield, beneath the anal opening, is likewise surrounded by a well-defined subanal fasciole. The basal portions of the postero-lateral ambulacra form broad, naked bands, between the posterior border and the mouth. The other characters resemble those of *Spatangus*, from which it differs however in possessing a *peripetal fasciole.*

Eupatagus De Koninckii, Wright, n. sp.

Syn. *Spatangus De Koninckii*, Wright, Ann. of Nat. Hist. vol. xv. p. 178.

The test of the original specimen of *Eupatagus De Koninckii* having had the external layer of its shell and consequently its fascioles denuded, we are now enabled to correct our determination of this species from a specimen in the collection of the British Museum, in which these important parts of the anatomy of the skeleton are well preserved. For the description of this Urchin see our article *Spatangus De Koninckii*, to which we subjoin the following note:—The peripetal fasciole is rather broad, surrounding with little undulation the ambulacral star, and forming a well-defined boundary between that portion of the upper surface with large perforated tubercles, and that part with very small tubercles; the subanal fasciole heart-shaped, rather broad, and enclosing a shield-like space filled with larger tubercles; it extends from the prominent point of the base to near the lower part of the anal opening.

Scalaria Duciei, Wright, n. sp. Pl. VII. fig. 4 *a*, *b*.

Diagnosis.—Shell turriculated, imperforate; spire gently tapering; whorls ten, with transverse prominent plates and longitudinal elevations. The transverse plates, nineteen in number on the body-whorl, are formed of numerous thin shelly laminæ, closely united where they proceed from the whorl, but outwardly they expand and form a rather irregular undulated surface; each plate describes three curves; two of these, the anterior and posterior, are short, and the central one is long, forming an arch over the whorl; the posterior, at their junction with the central curve, form angles, from whence blunt spiny processes proceed; these form a conspicuous ridge on the posterior upper part of the whorls; the junction of the anterior with the central curves forms a carina on the body-whorl, which commences at the posterior border of the aperture, and terminates at the anterior part thereof, at a distance from the umbilical ridge. The longitudinal elevations form a kind of cellular structure; between the plates they are seven or eight in number, and on them and the intervening surface of the shell, delicate longitudinal lines are sculptured. The aperture is entire, and is round or inclining to an oblong.

Dimensions.—Length $2\frac{2}{10}$ inches, diameter of the body-whorl $\frac{12}{20}$ths of an inch.

Collected from the calcareous sandstone No. 4, at Malta.

Lenticulites complanatus, Defrance. Pl. VII. fig. 4 *a*, *b*.

Genus Lenticulites, Lamarck. (Subkingdom *Radiata*. Class *Foraminifera*. Order *Hélicostègues*, D'Orb. Family *Nautiloidæ*.)—Shell nautiloid, equilateral, spire rolled on the same plane, compressed, sublenticular, multilocular; whorls apparent, opening narrow, triangular, prominent, against the penultimate turn of the spire.

Diagnosis.—Shell oblong, lenticular, much compressed; septa convex, with longitudinal partitions, growth lines very apparent. Long diameter $\frac{4}{10}$ths of an inch.

This beautiful Foraminiferous shell occurs in great abundance in No. 2, the yellow sand with blackish grains; in fact it forms large masses of rock in this bed. As it is constantly associated with the Echinoderms, we have added a drawing thereof. Defrance noticed, but did not figure this fossil; he collected it at "Anvers près de Pontoise, à Dax, à Loignan près de Bordeaux, à Boutonnet près de Montpellier, et en Italie dans les couches, qui paroissent appartenir au calcaire coquillier grossier*."

EXPLANATION OF PLATES IV. V. VI. AND VII.

PLATE IV.

Fig. 1. *Cidaris Melitensis*: *a*, the upper surface; *b*, side view of the ambulacral and interambulacral areas, natural size; *c*, an interambulacral plate, and a portion of an ambulacral area with the poriferous zones, magnified.

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* Dict. Sc. Nat. tome xxv. p. 453.

Fig 2. *Echinus Duciei*: *a*, upper surface, *b*, side view, natural size; *c*, the form of the mouth-opening, showing the disposition of the marginal notches, *d*, the five jaws and teeth "*in situ*," imbedded in a mass of rock, *e*, the apical disc, showing the arrangement of the genital and ocular plates; *f*, two interambulacral plates, and a portion of a poriferous zone, magnified

Fig 3 *Echinolampas Deshayesii* *a*, the upper surface, *b*, the under surface, natural size; *c*, a portion of the test, showing the tubercles, magnified; *d*, a portion of an ambulacral area, and poriferous zones, magnified.

PLATE V.

Fig. 1. *Brissus latus* *a*, the dorsal surface, reduced one-third in size; *b*, the apical disc, magnified, *c*, the perforated tubercles, with their crenulated bosses and encircling granules, magnified.

Fig. 2. *Brissus oblongus* *a*, the upper surface, showing the petaloid ambulacral star and peripetal fasciole, *b*, the under surface, showing the subanal fasciole, natural size; mouth, and the *trajet* of the naked basal portions of the ambulacra; *c*, the tubercles, and their circles of granules, magnified.

Fig 3 *Schizaster Parkinsoni*. *a*, the upper surface, showing the petaloid ambulacral star, the peripetal and lateral fascioles, the natural size, *b*, a portion of the peripetal fasciole, with the boundary granules, magnified, *c*, a portion of the poriferous zones, magnified

PLATE VI.

Fig 1. *Brissopsis Duciei* *a*, the upper surface, showing the petaloidal ambulacral star, surrounded by the peripetal fasciole, reduced one-third; *b*, six plates with small poriferous tubercles from the anteal sulcus; *c*, form of the pores, and arrangement of the tubercles in the poriferous zones; *d*, the larger perforated tubercles, and their crenulated bosses with their circlets of granules; *e*, a portion of the peripetal fasciole, showing how distinctly it is defined from the rest of the surface by rows of granules

Fig 2. *Brissopsis crescenticus* *a*, the upper surface; *b*, the under surface, natural size; *c*, the arrangement of the pores, near the apical portion of one of the zones.

Fig 3. *Schizaster Desori*: *a*, the upper surface; *b*, the under surface, natural size; *c*, the perforated tubercles, with their circlets of granules and crenulated bosses, magnified.

PLATE VII.

Fig 1. *Hemiaster Scillæ*: *a*, the upper surface, showing the ambulacral star and peripetal fasciole, natural size; *b*, the under surface of the same test; *c*, a lateral view, to show the great height of this species; *d*, the perforated tubercles and encircling granules, magnified, *e*, a portion of the single ambulacrum, showing the arrangement of the pores; *f*, a portion of a poriferous zone.

Fig 2. *Hemiaster Cotteauii*: *a*, the upper surface, natural size; *b*, the perforated tubercles, with their circles of granules; *c*, portion of a poriferous zone; *d*, portion of the peripetal fasciole, with its boundary granules.

Fig. 3 *Scalaria Duciei*: *a*, shell, the natural size, *b*, a fragment showing the mouth.

Fig. 4. *Lenticulites complanatus*: *a*, natural size of this Foraminiferous shell; *b*, a section magnified, showing the cells:—large rocky masses of this fossil occur in the yellow sand associated with the Urchins of that deposit.

XXV.—*On* Monopus medusicola, *a species of Leech.*

By Philip Henry Gosse, A.L.S.

[With a Plate.]

In my 'Devonshire Coast' (p. 359) I have mentioned the occurrence of a small Leech parasitic on the Medusa, *Willsia stellata.* As I have not been able to assign it to any recognized genus of the *Hirudinidæ*, I will here repeat the characters, give a figure of it, and appropriate to it a name. Though the note and the drawing taken of it at the time, are not so detailed as I could have wished them to be, yet as I can answer for their accuracy so far as they go, they will at least serve to identify the form, should it occur again.

Monopus (mihi).

Body soft, subcylindrical, depressed; anterior sucker imperfect; posterior a circular disk, at the extremity of a short thick truncate column, distant one-third of the total length from the anal extremity, on the ventral side. Anterior extremity obtuse; posterior briefly attenuate. Eyes eight, set around the frontal margin of the anterior disk. Intestinal canal straight, simple; anus terminal.

Monopus medusicola (mihi).

Less than 1 line in length; pellucid: eyes hyaline: parasitic on Medusæ.

The ovary was ample, and contained a number of clear, globular, highly refractile ova, variously grouped, in the posterior moiety of the abdomen. Close-set transverse annuli surrounded the anterior portion. The intestinal canal had two fusiform swellings, and was enveloped near the œsophagus with opake cloudy matter.

The generic name was suggested by the foot-like appearance of the posterior sucker.

EXPLANATION OF PLATE VIII B.

Fig. *a.* represents *Monopus medusicola*, ventral surface.
Fig. *b.* the same, laterally.

58 Huntingdon Street, Barnsbury Park, March 5, 1855.

XXVI.—*On* Ancylus oblongus *and* A. fluviatilis.
By William Clark, Esq.

To the Editors of the Annals of Natural History.

Gentlemen, Norfolk Crescent, Bath, March 1855.

I present an account of two very interesting members of the subaquatic pulmoniferous family of the *Limneadæ*, the *Ancylus oblongus*, often termed "*A. lacustris*" or *Velletia lacustris*, and the *A. fluviatilis*, which have heretofore caused some difficulty with respect to their relations with each other and to natural position, and even now excite attention; but I believe these animals have been brought to a pretty safe anchorage by the Rev. M. J. Berkeley. I have in some of our scientific publications read his observations on one or both (?) these species, but they have escaped my memory, and I have not at present the means of reference; the ground therefore is almost new to me, with this advantage, that whatever errors I may commit, will be corrected by consulting that eminent naturalist's notes; and perhaps my comparison of the two animals with each other, and with the *Limneadæ*, may offer some new points of view, both as regards their internal anatomy and external aspects, and the generic considerations connected with natural position. I have been tempted to enter on this memoir in consequence of the extraordinary abundance, at Exmouth in 1854, of both these species, and one of the standards of comparison, the *Limneus pereger*.

No genus has received greater changes of position than *Ancylus*; the only two British species have even been consigned to separate genera, the *Velletia lacustris* and *A. fluviatilis*,—a most unfortunate disseverance, as the organs of both are all but identical. The animals have been pronounced at one time Pectinibranchiates, at another Cervicobranchiates, and agreeably to the surmises of conchologists have been passed to and fro, from their most ancient site as Cyclobranchiates, to *Haliotis*, *Crepidula*, &c. The zoologists who have assigned them a natural location are Mr. Berkeley, Dr. Gray, and M. de Férussac: as to the Rev. L. Guilding, whom M. Deshayes quotes as a dominant authority, his account of the animal of *Ancylus* is very incorrect.

As I consider *Ancylus* more in harmony with the Limneadan type *L. pereger* than either *Physa* and *Planorbis*, I should have preferred depositing it as a section of that genus, but I fear the present race of malacologists are not prepared for so decided a measure. I have adopted the *A. oblongus*, the *Velletia*, nonnull., from having given it a close examination, and as being the dextrorsal species, for the type of the genus *Ancylus*, and the standard of comparison with the *A. fluviatilis* and *Limneus pereger*.

Ancylus oblongus, Brit. Moll. vol. iv. p. 188 pl. 122. fig. 5.
Ancylus lacustris, auct.
Velletia lacustris, nonnull.

Shell an elongated, subdepressed, laterally compressed, coarsely wrinkled light horn-coloured cone, with a posterior somewhat horizontal vertex.

Animal pale yellow drab, aspersed with dark lead- or cloud-coloured minute points varying in intensity;—we have thus at the outset the characteristic colouring of the Limneadan tribe.

Though the shell is of similar character with the *A. fluviatilis*, the organs instead of being heterostrophe as in that species are dextrorsal.

The mantle is even with the margin of the shell and bounded by a frosted line, within which are three irregular, somewhat distant, peripheral cordons of minute, hyaline white, comma-shaped fillets, the whole having the aspect of a spangled fringe: this, and the form of the shell-cone, are the nearest approaches to *Patella*, with which genus it has generally been associated by the older authors. The head is flat and broad, springing from a short thick neck, and forming a rather elongated hood or veil, emarginate in the centre, so as to appear bilobed, having the edges finely crenate: there are no head or neck lappets, but there is a medial rib terminating in a small limited erect flap at the anterior point of the head, beneath which is the crosial puckered buccal orifice leading to a palate of two soft fleshy lobes rounded in front and pointed behind; between these a tolerably long tongue, with the rachis garnished by extremely close-set fine wiry laminæ, that incline posteriorly like the strands of a feather, and pass through the œsophagus into the stomach.

The two tentacula are contractile, short, flat, subtriangularly tapering to a rounded termination, very divergent, with large eyes in front at their bases, with rather an internal inclination. The foot is a narrow elongated oval disk, rounded at both ends, and has a very limited locomotion.

The œsophageal collar or brain consists of two principal and other smaller ganglia in close contiguity, which throw off the usual nervous threads, and on each side of them are the pale yellow subrotund lobular salivary glands. The muscular system exhibits no peculiarity, distributing to every part of the body the necessary strands, and displaying their interlacements at all angles and planes.

The stomach is white, submedially transversely contracted, and divided by a depressed line which gives a bilobed aspect; it is ridged externally at the cardia, and within is furnished with muscular fillets; the intestine is simple throughout, and on leaving the pylorus winds to the dexter side, terminating just within the respiratory cavity. The liver is a large pale greenish-yellow granular mass, deposited below the muscle around the upper part of the cone.

The sac of viscosity is in close union with the pericardium, inclining to the left of the dorsal region, the canal of which from its minuteness escaped our research, but it doubtless is concurrent with the intestine and rectum. The heart and auricle, of pale yellow, are at the bottom of the left side of the respiratory vault. The ovary at the apex of the spire, of a yellowish-white colour, is attached to the hindermost lobe of the liver, and presents the figure of a subrotund granular mass or minute bunch of grapes, having a slender twisted or sinuated white oviduct that enters the matrix at its lowest point. The very small bladder is white, sometimes pale blue, elongated or flask-shaped; it floats by its long canal between the testicle and matrix, and probably pours its contents into the latter, but the extreme minuteness of the parts did not permit us to verify that point. The testicle is a large granular mass, and can be seen through the mantle, lying on the dorsal region posterior to the heart and auricle, partially united to the lower portion of the matrix, which is of very irregular diameter; the *vas deferens* is easily traced to the termination of the verge.

The verge is under the right tentaculum and is retractile: we have seen it in every phase: in the genial season it is large, fleshy and subcylindrical. The orifice of the matrix is very considerably below it, close to the valve of respiration. It is difficult to conceive how such a constituted animal should be mistaken for a Pectinibranchiate, unless, as is mentioned below, the packet of parasites has passed for branchial filaments. The mantellar collar, which is more or less an attribute of all the Pulmonifera, is in the *Ancyli* a slender cord, plain on the left side, but forms at the respiratory cavity a rather elongated narrow expansion or fillet, which we have often seen the animal elevate for respiration, or to eject the fæcal rouleaus: when the organ of respiration is opened, the network does not appear greatly developed: the artery, vein, and the descending aorta could not be verified. The heart and auricle are with difficulty observed in the pericardium.

The above observations show that this animal is a true Limneadan: we do not pretend that they are without error, for it is extremely difficult to separate and define the exact position and precise form of the organs of so minute a creature.

We hope to prove that the next species, the sinistrorsal *A. fluviatilis*, is an undoubted *congener* of our present animal, and that both will be acknowledged to have every essential character of the *Limnei*.

The reproduction of the *Ancyli*, and *Limneadæ* in general, is that of the *Helicidæ*, a congressional hermaphroditism, though differing in some curious particulars. Our dredger has repeatedly verified in this species the recorded accounts of the singular androgenous concatenations of this family when under the genial influences,—another proof of their race, from habitudes, independent of animal structure.

This species abounds at Exmouth on aquatic plants. I have never seen it on stones, as is generally the case with *A. fluviatilis*. The animal at this season (July) is infested with fourteen to twenty or more of a species of *Gordius* or *Filaria*, which are slender, cylindrical, and very vivacious, blunt or rounded at both extremities; they fix themselves between the mantle and the body around the pedicle of the foot, and are in constant vibration,—so much so, that a novice might mistake them for branchial filaments. One would suppose that such a colony of vigorous parasites must greatly annoy the "*bénéficiaire*:" I have examined 100, and all had this retinue.

Ancylus fluviatilis, auct.

The *shell* presents a more elevated and regular cone than that of the *Ancylus oblongus*, and when cleansed from its ferruginous coat, is of a clear, very light, delicate horn-colour, and adorned with fine close-set raised striæ that diverge from the apex to the periphery of the aperture; the vertex is posterior.

The *animal* is so generically similar to the preceding species, that it will not be necessary to do more than to present a comparative view of their organs.

This species is sinistrorsal, but that is a mere accidental condition involving only a transposition of the organs. The principal variation as regards the shell is its more circular figure, and in respect of the animal, the foot is shorter and broader, the result of the less elongated cone; otherwise it is of similar shape and rounded at both ends; the colours only differ in being of a more quiet drab, speckled with white points, instead of the pale golden-yellow hue and minute lead-coloured lines or dots that prevail in the *A. oblongus*.

The head, hood, veil, and buccal apparatus of the two, scarcely vary, beyond the crosial orifice of the latter organ in this animal being more rayed and finely puckered, within which is a similar palate of two fleshy lobes rounded in front and pointed behind; from thence a rather shorter and broader tongue passes through the œsophagus to the stomach; the œsophagus is inserted a little on one side of the cardia, and when withdrawn by force presents a bluish-white, bulbous, minutely perforated termination. The configuration of the stomach is nearly the same in both species; it is ridged externally at the cardia, and at one-third of its length from thence becomes slightly constricted, and then expands into a subglobose or bursiform sphere oblate at the pyloric axis; in the interior it is furnished with muscular raised fillets, and is usually filled with a white pulp; the duodenum and intestine make about a fold and a half in the liver, terminating as rectum close to the respiratory cavity; these organs are of a pale brown colour, finely circularly striated, and when placed in extension are less than half an inch long; they have no twists, cæca, or inflations; the stomach is of a brownish-gray; the liver is dark brown, and more granular than in the last species. The tentacula and eyes scarcely differ: in this, the mantle is plain, and without the comma-shaped points of the *A. oblongus*. The verge is white, long, large, fleshy, subcylindrical, retractile, issuing under the left tentaculum; the orifice of the matrix is quite as distant from it as in its congener, being close to the respiratory vault, and accompanied by a minute vesica. The mantellar collar is a gently inflated cord, expanding on the right and left hand, according as the condition is dextrorsal or sinistrorsal, into a small, oval, flat fillet, which the animal elevates when it respires or evolves the rejectamenta. In both, the rectum and canal of the viscous lobe debouche in close connexion with the respiratory cavity, which is situated about one-third from the posterior end, so that the interval of separation between the matrix and verge is nearly at opposite extremities. The pulmoniferous cavity displays, though only with high powers, the heart, auricle, and principal veins, as in its fellow. The lobular salivary glands, and the brain, of two principal and smaller ganglia, differ but slightly; here the nervous masses are more concentrated. All these points, with those not mentioned, as the ovary, testis, *vas deferens*, are so essentially alike, as to render distinction only amenable to very insignificant specialties.

If we compare our *Ancyli* with one of the principal Limneadan types, the *L. pereger*, we shall find the generalities substantially the same; and in respect of the specialties, the stomach of the '*pereger*' is more contracted and taper at the cardia, with the constriction lower, and the intestine more than proportionately longer. The mantellar collar is also more firmly pronounced, in consequence of the shape of the aperture. As to other external variations, the head may be flatter, the tentacula broader and more membranaceous, and the shell of a greater or less extended spire. The salivary glands are conspicuous, and the nervous masses of the brain, as in *Ancylus*, consist of larger and smaller ganglia. The muscular structure of the *Limneadæ* offers no points for particular remark.

Some naturalists, as already stated, have removed from *Ancylus* the *A. oblongus*, their *Velletia lacustris*, on the grounds of generic considerations; we think our present notes will dissipate these views. They adduce as an argument for distinction, independently of structural contour, that the woof or histology of the lingual riband is very different in the two. We do not dispute this point, but consider it of no importance except as a specialty, and observe, that if such variations are to be regarded as the elements of generic composition, we feel confident that naturalists who adopt them will involve their generic states in inextricable confusion. We have examined the lingual ribands of many species, and found singular discrepancies, not only in the species of a genus, but in the same species, that have convinced us of the unfitness of such bases for generic dispositions. It may be admitted that the dentition of the Vertebrata has been of use, especially in fossil cases, as generic aids, but there is little analogy between it and the tongues of the Gasteropoda.

In the many *Rissoæ* we have examined, we have found the persistent frame of the riband, independent of the *uncini* and other accessories, vary. We believe the same may be said of the other Gasteropodan groups; at the same time we do not deny that some of them show a rough similarity of conformation, but it is unsatisfactory, and inapplicable for stable and decisive generic determination.

The late Professor Forbes at one time thought favourably of M. Lovèn's views, and sent me a copy of the Swedish pamphlet, requesting my opinion of the value of the gasteropodan lingual riband. After a laborious and painful examination, in consequence of the minuteness of the Rissoidean ribands, I replied, that I did not think the employment of the tongue of the Gasteropoda, as a means of a new generic distribution, would be attended with valid results, and that I was bound to say, I greatly feared, if adopted, it would prove a source of much confusion and unnatural determination. Professor Forbes, in reply, informed me that, in consequence of a severe attack of fever, he could not for a week or two make any comments on my communication, and the subject was never afterwards renewed.

Though the learned Professor, in his excellent 'British Mollusca,' has frequently mentioned the lingual ribands, I believe he never considered them as likely to become the accredited bases of generic construction, for it is apparent throughout his descriptive notes that almost every species of each genus not only varies in its accessorial garniture, but also often in its fundamental structure. The only instance in which he speaks with anything like impression on the gasteropodan tongues, is on the transference of the minute *Murices* to his *Conidæ*. Yet, strange to say, though he admits that they, his *Mangeliæ*, have the vital organs of the *Murices*, he removes them from their legitimate station as species of that genus to one different, both as regards the structure of the shell and animal,—to the *Convolutidæ*, on the ground of their dentition approaching that of the Cones. But even here there is error, as some of the tongues of his *Mangeliæ* are of muricidal type. Notwithstanding our deference, we think that this great zoologist has *here* failed to define the true limits of generic composition.

To attempt a classification on such elements will assuredly induce deplorable results, by the disseverance of groups and families that are now indissolubly united by nature through the identity of every essential organ. The dispersion consequent on such a proceeding cannot fail to dislocate, more or less, every genus, and consign its species to a false malacological position. We need go no further than our present memoir to prove the fallacy of the lingual riband test, which has split our *Ancyli* into two genera, *Ancylus* and *Velletia*, the tongues of which differ materially in composition, whilst every other organ pronounces them congeneric and of true Limneadan extraction.

We ask, then, can zoologists for a moment put into competition the essential consentaneity of all the important organs of the *Ancyli*, excepting the details of the lingual riband, and contend that the variations in its fabric ought to swamp an identical concatenation of every other source of vitality, and entitle it to become the dictator of natural position? The supporters of such a doctrine might with more reason have adopted the variations of the nervous ganglia, or of any other organ, for the basis of a new scheme of generic arrangement, instead of the very worst and most fallacious: and even if there were any value in their view, it cannot be used, from the difficulty, in a thousand instances, of being put into practice: then why make the attempt, when we have other means of easier and more sure application,—the comparison of the united organs and physiological states of the different animals? We think that the tongue of the Gasteropoda will never exercise a greater influence than as a specialty of excessive variableness.

The habitat of this species greatly differs from *A. oblongus* in being rarely attached to aquatic plants, and then only in deep, slow rivers, whilst its congener is never fixed to stones. At

Exmouth and its vicinity every brook abounds with these creatures, adhering like limpets to pebbles, and encrusted with a ferruginous deposit from the waters. It is difficult to conceive how they can with safety come to the surface to breathe pure air, as in winter and spring during the freshes, and even in summer, the gentlest current would probably drive such light and delicate animals down the stream, and cause them to perish if they ventured to quit their moorings; they must therefore of necessity remain at anchor under the influence of a *Patella*-like adhesion, unless they have the power, when they wish to breathe pure air, of veering out a filamentary cable, by which they can withdraw again after respiration to their original site; or, that they, and all the *Limnei*, though pulmoniferous, can, from some peculiarity of the respiratory organs, extract, for an almost indefinite time, sufficient vital fluid for aeration. These alternatives are not, perhaps, very improbable hypotheses, but at present we cannot determine which of them may solve the difficulty.

The animal, though its habitat is so different, is infested by the same parasites as the *A. oblongus*. We sum up and conclude with the single remark, that both our British *Ancyli* are congeneric, and have essentially similar organs as all the *Limneadæ*.

I am, Gentlemen,
Your most obedient servant,
William Clark.

XXVII.—*On* Actinophrys Sol. By E. Claparède.

[Concluded from p. 217.]

I ascertained nothing new with regard to the mode of propagation of *Actinophrys*. I have never witnessed decided instances of conjugation, but have often observed circumstances which indicated either a division or a conjugation. One instance of actual division has however occurred to me. Kölliker, Cohn, and Stein have mentioned perfect conjugations. Perty also refers to a similar phænomenon in his *Actinophrys brevipilis* (*brevicirrhis* ?), and even mentions a mutual conjugation of seven individuals of *A. Eichhornii*. Stein also speaks of the conjugation of several individuals of his *A. oculata*, and states that he has found seven individuals in conjugation. It does not however appear probable, from the words he employs, that he saw these seven individuals separate, and it appears to me that we are not justified in concluding that every compound form is produced by conjugation, as Stein and Perty are inclined to do. We know, in fact, very little about the signification of these processes in the Infusoria, and if it be proved that more than two individuals may thus be fused together, the connexion of these phænomena with reproduction will become exceedingly doubtful. The word *conjugation* might in this case be dropped, as it leads the thoughts involuntarily to the wonderful process by which fertilization is effected in *Spirogyra* amongst the Algæ, or in *Diplozoon paradoxum* and the *Gregarinidæ* amongst animals, replacing it by Stein's expression *process of fusion*, or as Ehrenberg has it, *zygose*. But what would then be the meaning of the phænomenon? Ehrenberg * regards it as a means of invigorating the species, which is certainly a curious idea, and not very reconcilable with the ordinary laws of nature.

Whether *Actinophrys* has any other mode of propagation besides self-division is unknown. On this subject Nicolet has produced a very singular memoir, of which an abstract is to be found in the 'Comptes Rendus' of the Academy of Sciences of Paris for 1848; I can, however, put no faith in it. He professes to have seen an ovary enclosed in a membranous capsule, and another sexual gland in *Actinophrys*! Ehrenberg does not go so far as this, although it was of such importance to him to point out organs which he could represent as ovaries and seminal glands; he is contented with saying, "The pale round space in the middle which Muller saw on desiccation, may be the male sexual glands, which I have never made out quite clearly. A granular cloud may be connected with the ovaries." Nicolet asserts that *Actinophrys* lays eggs, from which *Halteria grandinella*, Duj. (*Trichodina grandinella*, Ehrb.) is evolved. In a second mode of propagation the young are developed from germs preexisting in a wheel-animalcule, the *Rotator inflatus* (*Rotifer*?)! These germs produce *Halteriæ* "qui s'échappent en sautant." Perty states that *Podophrydes* are developed from *Actinophrydes*, which however is scarcely reconcilable with Stein's observations upon the *Acineta*-like state of the *Vorticellæ*.

We come now to the interesting but controvertible question of the anatomical structure of *Actinophrys*. Kölliker's observations and my own have satisfactorily proved that no value is to be attached to the assumption that this animal possesses a mouth and an anus. It is equally impossible to admit the existence of a general integument, as *Actinophrys* can push out the mucous or gelatinous matter of which its body is composed, take in nourishment, or evacuate the residue of digestion, from any point of its surface at pleasure. Thus, Siebold's assertion that when the contractile vesicles are protruded the integument retains sufficient elasticity to drive the nutritive fluid back into the parenchyma, also falls to the ground, and we must endeavour to explain this phænomenon in another way. Perty indeed states that in *Actinophrys viridis* he has distinguished a capsule, perhaps only optically of a reddish colour, and its contents, consisting of closely packed green globules. The capsule appeared to him to be double, but the two laminæ were united in different places, so as to give it a waved appearance. He also ascribes the same character to his *A. brevipilis* (*brevicirrhis*?). His figures, however, show that this notion has arisen from an illusion. *Actinophrys Sol* often presents the same tuberculated appearance, and Perty's supposed skin is nothing but the cortical layer already mentioned. He would probably have adopted a different opinion if he had seen the animal in the act of taking nourishment.

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* Bericht der Berl. Akad. April 1854.

The entire mass of the body in *Actinophrys* appears to consist of the same substance,—*sarcode* as Dujardin would call it. This substance, which occurs in all Rhizopoda, looks like a tough mucus or thick jelly. The radiating processes are also composed of the same material; of this we may easily be convinced, if we observe the animal when it is slowly extending or contracting its processes, or when the latter are seen bending and fusing together. I have never seen these processes become stiff, as Perty states, so that other Infusoria could *impale* themselves upon them, and I have no hesitation in regarding this as an impossibility. It is nevertheless quite certain that small animals and plants remain adhering to them, for these rays are true tentacles. Indeed their contact must have something very unpleasant about it, for larger Infusoria, even such as *Paramecium Aurelia,* on coming accidentally within their reach, start back with the greatest rapidity, sometimes even dragging the *Actinophrys,* to which they have incautiously attached themselves, a considerable distance with them.

Like Kolliker, therefore, we refer *Actinophrys* to the Rhizopoda, but we cannot adopt his views as to its constitution. Thus he adopts Dujardin's sarcode without reservation, so that these wonderful creatures would consist of a structureless body, a homogeneous contractile substance without mouth, intestine, or any other organ; and finally, at least according to Kölliker, they would be unicellular animals. I cannot, however, agree in the least with this latter view. *Actinophrys, Amœba, Arcella,* and the other Rhizopoda, are entirely destitute of an integument; the *cell-membrane* is consequently deficient. I must equally deny the existence of a *nucleus* in the naked Rhizopoda (at least in

Actinophrys Sol and *Amœba diffluens*), and the shell-bearing forms (at least *Arcella*) are also probably destitute of this structure, but the opacity of the shell in most of these prevents us from arriving at any certainty. Kolliker himself was aware of these facts, nevertheless he regards the Rhizopoda, like all the other Infusoria, as cells. But then, I would ask, what remains as the characteristic of a cell, if both nucleus and membrane may be wanting at the same time? Kolliker indeed raises the question, whether it be not possible that the young Rhizopoda are true cells, and that the nucleus and membrane afterwards disappear, as is the case, for instance, with the nucleus in the blood-corpuscles of man. We may conceive the possibility of this, but where do we find any proof it? Has any observation supporting it ever been made? Ehrenberg himself, to whom it was of such importance to find sexual organs in his Polygastrica, admits that he could never clearly make out the seminal glands (nucleus) of *Actinophrys*. Very small individuals (and I have had them much smaller than those observed by Kolliker) treated with dilute acetic acid exhibited no trace of a nucleus. This supposition, that *Actinophrys* and other Rhizopoda pass through a previous cellular condition, has consequently no foundation in fact.

A cell consists of three parts,—nucleus, membrane, and contents. If Kölliker asserts that the coexistence of these three parts is not indispensably necessary, and that even two of them may be deficient,—that, for example, we may attribute the signification of a cell, to the contents remaining alone, and contained in nothing,—I must confess that such an idea is beyond my power of conception. A cell without nucleus and membrane appears to me to be much the same as a man without body and soul, a thing which perhaps may be, but will certainly be no man. If, therefore, with Kolliker, we regard the Rhizopoda as a class of unicellular animals, the organisms which it includes will be principally distinguished by their having nothing to do with cells, as they consist of a shapeless mass of a structureless homogeneous substance.

Kölliker, however, refers all Infusoria to his class of unicellular animals. He does not even support his view by arguments; for he assumes that the fact "cannot be subject to the slightest doubt, with any one who will only examine an *Opalina*, a *Bursaria*, a *Nassula*, &c., pretty closely." Nevertheless, we shall venture to put forward some opinions upon this subject. We are not yet convinced that in *Loxodes bursaria,* the so-called chlorophylle grains are not chlorophylle vesicles (they often occur perfectly colourless), with which the wall of the body is covered. They are closely attached to this wall, and very regularly arranged. If they be granules, they might even be regarded as nuclei, of a nature quite different from that of the so-called nucleus of *Loxodes*, which would then probably have to be regarded as quite a different organ. But, not to dwell any longer upon mere suppositions, let us pass to the *Vorticellæ*. How can these animals, with their composite structure, their bell, their nucleus, stalk, muscle, &c., be described as unicellular? The muscle of a *Vorticella* is evidently as distinct and independent an organ as any muscle in a higher animal. It even possesses the second elementary tissue, the elastic cylinder. Even the cilia of the true Infusoria indicate a much higher organization than that of an unicellular creature, and I do not think that they can be regarded as mere excrescences of a cell. It is very probable that both nerves and muscles exist, although our present instruments are insufficient for their discovery. The movements of the cilia in the Infusoria cannot be compared with those of a ciliated epithelium. The latter goes on involuntarily throughout the life of the animal, and sometimes does not cease even with its death. In the Infusoria, as in the Rotatoria, on the contrary, the movement of the cilia is entirely voluntary. No one, in fact, can overlook the great similarity of the ciliary apparatus of the Infusoria with that of the Rotatoria, but no one will regard the latter as mere appendages of cells; from these to the tentacles of the Polypes is only a single step. In short, it is equally impossible to regard a *Vorticella* or a *Stentor*, and a *Hydra*, or any other Polype, as a single cell.

We have already proved that the Rhizopoda are not single cells, but what are the arguments in favour of their multicellular constitution? Dujardin, true to his theory, has chosen the name *sarcode* with great judgment, to express a substance which he considered to replace the muscles of the higher animals. But this cannot be the only function of sarcode;—it must also act like nervous matter in conducting sensation and will; it must separate the fluid which serves for the solution of the alimentary matters, and secrete various materials like horn or chitine (*Arcella*), or adhesive substances (*Difflugia*, &c.), for the formation of the shell; in short, it must be able to perform all the functions necessary for the support and propagation of the animal. It is very difficult to understand how a structureless mass can secrete two quite different substances in the same animal (as, for example, in *Arcella*), one of which solidifies into a shell, whilst the other serves for the solution of nutritive matter. The numerous functions performed by these organisms render it highly probable that this, so-called, amorphous, structureless mass will be found to be of a more composite nature, when we get more perfect instruments than those of which we can now avail ourselves. How can we imagine that the will of a nerveless animal can influence a structureless substance? If we consider how difficult it is to make out the nerves even of comparatively large Radiata, we should not deny the existence of a nervous system because we cannot find it at once.

As regards *Actinophrys Sol* in particular, we must either drop the class of unicellular animals altogether, or refer this animal to some other place. Even if we admitted that *Actinophrys* was the equivalent of a cell, it would still not be unicellular, for an endogenous cell-production has taken place in it. The contractile vesicle is nothing but a cell. In other Infusoria it may be considered that this organ is merely a cavity or vacant space in the sarcode. But such an assumption is quite impossible in *Actinophrys*. In this animal the contractile vesicle is brought to the surface in such a manner, that Siebold, who assumed the existence of an integument, was astonished that this should retain sufficient elasticity to drive the nutritive fluid back into the parenchyma. As it is now certain that *Actinophrys* possesses no integument, the phænomenon becomes still more wonderful. The organ, when dilated, looks like a thin soap-bubble, and exhibits a simple margin. How then can we explain the return of the fluid by the contractile sarcode? Would it not be contrary to all the laws of mechanics, that the fluid should rather force its way through the tough, thick mass of the body, than break through the extremely thin wall of the contractile vesicle, consisting of the same substance, which alone separates it from the external water? It is only necessary to observe the action of the contractile vesicle of an *Actinophrys* for a few minutes, to be convinced of the presence of an including membrane. At least, no doubt remains in our mind upon this point. And if the presence of this membrane in *Actinophrys* be once received, its existence in the other Infusoria becomes all the more probable. In fact, we are justified in supposing that not only the contractile vesicle, but also the pyriform outlets of *Paramecium* are clothed with a proper membrane. Kölliker himself supposes that the contractile vesicle, when present, is the equivalent of a cell-membrane. With the proof of the existence of such a formation in *Actinophrys*, his hypothesis of the unicellular constitution of that animal consequently falls to the ground.

[Throughout this memoir the author speaks of the animal upon which his observations were made as the *Actinophrys Eichhornii* of Ehrenberg. In a supplementary note, however, he states that he was in error in the determination of the species, and that the animal was really the *A. Sol*; under these circumstances we have substituted the latter name for the one adopted in the paper.

The author also states that the animal described by Kölliker under the name of *Actinophrys Sol*, is the *A. Eichhornii*, Ehrb., but adds, that specimens of that species, which came under his notice after the printing of his paper had commenced, agreed exactly, in regard to the contractile vesicle, with those which formed the subject of his previous investigations. He did not observe it in the act of feeding.

He also states that *Arcella vulgaris* possesses as many as ten contractile vesicles, and that he was in error in ascribing only two of those organs to that Rhizopod.—TRANSLATOR.]

EXPLANATION OF PLATE VIII

The letter *o* indicates the contractile vesicle throughout all the figures

Fig 1 *Actinophrys Sol*, in its ordinary sun-like form

Fig 2. *A Sol*, in the act of division or conjugation, with two contractile vesicles

Fig. 3 An *Actinophrys* in the act of feeding A *Chlamidomonas* and an *Astasia* have just been enclosed by the slimy substance

Fig. 4. An *Actinophrys* in the act of pushing out the slimy substance (*a* and *b*).

Figs. 5 & 6 Peculiar and unusual forms of *A Sol*.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

January 18, 1855.—Sir Benjamin Brodie, Bart., in the Chair.

"On the Dots upon the Valves of the Diatomaceæ." By J. W. Griffith, M.D., F.L S.

In a former paper, it was stated that the markings or dots upon the valves of the Diatomaceæ, are the optical expressions of depressions existing upon the valves.

All those authors who have paid special attention to the Diatomaceæ, have considered the markings to denote cells, among these we find Ehrenberg*, Kützing†, Ralfs‡, Smith§, and Quekett‖.

The evidence I adduced in regard to the more coarsely marked Diatomaceæ, as *Isthmia*, &c., being furnished with depressions and not cells, is, I believe, satisfactory and conclusive; and this view has been admitted in a paper since read before the Royal Society¶.

A different view has been taken of the nature of the *finer* markings, as those upon some species of *Gyrosigma*, by the author of the paper last quoted, as by previous authors; and the object of this note is to direct attention to the support which the extended view argued for by me in the paper above referred to, viz. that the finer markings also correspond to depressions, derives from analogy.

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* Die Infusionsthierchen.

† Die Bacillarien, and Spec. Algarum.

‡ Annals of Nat. History, 1843.

§ British Diatomaceæ.

‖ Histological Catalogue of the College of Surgeons; and Lectures delivered before the College of Surgeons.

¶ Proceedings of the Royal Society, June 15, 1854.

The structure of the Diatomaceæ, and their modes of reproduction, are, as is well known, remarkable;—so much so, that these organisms have been claimed by botanists as members of the vegetable, and by zoologists as belonging to the animal kingdom. The preponderance of evidence is decidedly in favour of their vegetable nature; but, be this as it may, they must all be classed together,—they form a perfectly natural family Hence we have a strong argument in favour of the markings upon their valves being identical, and as these are evidently depressions in the genera and species with coarsely marked valves (*Isthmia*, &c.), we should expect from analogy that the same would apply to those with finer markings. And this view receives further support, from the fact, that under varied methods of illumination, corresponding appearances are presented by the markings when viewed by the microscope, from those which are very large, as in *Isthmia*, through those of moderate and small size, as in the species of *Coscinodiscus*, down to those in which they are extremely minute, as in the species of *Gyrosigma*, &c. The angular (triangular or quadrangular) appearance assumed by the markings, arises from the light transmitted through the valves being unequally oblique This may be readily shown in the more coarsely marked valves (*Isthmia*, *Coscinodiscus*), which present the true structural appearance when the light is reflected by the mirror in its ordinary position, and the spurious angular appearance when the light is rendered oblique by moving the mirror to one side.

ZOOLOGICAL SOCIETY.

December 13, 1853.—R. C. Griffith, Esq., in the Chair.

Descriptions of New Species of Bucconidæ.

By Philip Lutley Sclater, F.Z.S.

1. Bucco radiatus, Sclater. *B. supra clare ferrugineus, nigro transversim radiatus, nucha et dorso summo pæne omnino nigris; corpore subtus et torque cervicali supra pallide fulvescenti-albis, capitis lateribus, pectore et ventris lateribus lineis nigris transversim radiatis, loris, gula, ventre medio crissoque albis; pedibus nigris; rostro plumbeo.*

Long. tota 8·0; alæ, 3·4, caudæ, 3 0.

Hab. in Nova Grenada. Mus. Britannico.

Obs. *B. chacuru* affinis, sed subtus radiatus et rostro plumbeo nec rubro; maculis auricularibus nullis.

2. Bucco striatipectus, Sclater. *B. corpore supra nigrescente, alis caudaque magis brunnescentibus, omnino rufescente transversim striatis; capite nigro fere immaculato; mento albo; gutture toto et collo undique fulvo-rufis; pectore et ventris*

lateribus albis, nigro longitudinaliter striatis; ventre medio albo, crisso fulvescente.

Long. tota, 7·8; alæ, 3·5.

Hab. in Bolivia. Mus. Derbiano.

Obs. Species *B. maculato* maxime affinis sed subtus striis nigris nec maculis rotundis aspersa.

3. Malacoptila fulvogularis, Sclater. *M. capite toto et dorso summo nigris, scapis plumarum clare fulvis; dorso, alis caudaque fuliginoso-brunneis; dorso medio punctis paucis triangularibus fulvis; uropygii plumis anguste fulvo marginatis, cauda immaculata, mento et gutture toto clare fulvis, pectore nigro, scapis plumarum late albis, ventre pallide fulvescente.*

Long. tota 8·5; alæ, 3·7.

Hab in Bolivia. Mus. Derbiano.

Affinis *M. torquatæ*, Hahn.

4. Malacoptila substriata, Sclater. *M supra umbrino-brunnea, capite nigrescentiore; capite et dorso summo longitrorsum fulvo striolatis; dorsi et uropygii plumis rufescentibus, ochraceo anguste marginatis, alis caudaque immaculate cinerascenti-brunneis, loris et mystacibus elongatis, albis, lateribus capitis et corpore infra nigrescentibus, ochraceo et albo late striatis; gula media et pectore toto rufescenti-ochraceis, ventre brunneo et ochraceo-albido confuse mixto, cauda subtus cinerascentiore, rostro pedibusque nigris.*

Long. tota, 7·8; alæ, 3·8, caudæ, 3 8.

Hab. in Nova Grenada.

5. Malacoptila aspersa, Sclater. *M. supra fuliginoso-brunnea, dorso rufescentiore, alis caudaque immaculate brunneis; nucha, dorso toto et alarum tectricibus maculis triangularibus, clare fulvis, aspersis; loris albescentibus, regionis auricularis plumarum scapis pallide fulvis, mystacibus et plumis mentalibus rigidis, gula alba, pectore in ferrugineum transeunte; ventre toto crissoque obscure albis, ferrugineo tinctis, pectore et ventris lateribus obsolete fuliginoso-striatis, rostro nigro, mandibula inferiore ad basin flava, pedibus obscure brunneis.*

Long tota 7·25; alæ, 3·2; caudæ, 3 2.

Hab. in Venezuela. Mus. Britannico.

Obs. Species præcedenti et *M. mystacali*, Lafr., quasi intermedia; coloribus corporis superi huic, inferioris vero illi approximans.

I am at present acquainted with about thirty-two species of the fissirostral family *Bucconidæ*, of which I believe the five just described to be hitherto unrecognised. Two of them are to be found in the Derby Museum at Liverpool, of two there are specimens in the British Museum: the only example of the *Malacoptila substriata* I have yet seen is in my own collection..

Four natural genera have been constituted in this family, *Bucco*, *Malacoptila*, *Monasa*, and *Chelidoptera*. For the more debile and

passerine form of *Malacoptila*, represented by the *Bucco rubecula*, Spix, and *Lypornix ruficapilla*, Tschudi, I propose the new generic or subgeneric appellation *Nonnula*, type *N. rubecula* (*Bucco rubecula*, Spix, Av Bras. i. t. 39. fig. 1. p 51). The members of this section are much inferior in size to the true *Malacoptilæ*.

DESCRIPTIONS OF SOME NEW SPECIES OF EXOTIC MOTHS BELONGING OR ALLIED TO THE GENUS SATURNIA.

BY J. O. WESTWOOD, F.L.S. ETC.

Having, in a former Article in this work, ('Annals' for April 1850, p. 290), reviewed the whole of the known species of large African moths belonging or nearly allied to the genus *Saturnia*, and having also, in the "Cabinet of Oriental Entomology," described and figured a number of species of the same group from various parts of India, I purpose in the present paper to describe several additional species, chiefly from the New World, which appears to be very rich in these fine insects. For several of the species contained in this memoir I am indebted to D. Coffin, Esq , who on his return from Mexico most liberally presented me with his whole collection, formed in that country during a residence of considerable extent.

SATURNIA ORIZABA, Westw. *S. alis anticis maris subfalcatis, posticis elongatis; in utroque sexu fulvis, brunneo griseoque variis, omnibus plaga magna triangulari (in omnibus alis æquali), apice extus in strigam undatam albam intus nigro marginatam, insidenti, macula subapicali alarum anticarum e guttis tribus nigris composita, linea tenuissima nigra valde undulata submarginali serie macularum parvarum in alis posticis includente.* ♂ ♀

Expans. alar. antic maris, 5¼ unc., fœm.: 6¼ unc.

Hab. in Mexico. Communicavit D. Coffin. In Mus. Westwood.

This species is closely allied to *Sat. Aurota* (Cramer, pl. 8. fig. A), from Surinam, but differs at once in the form of the vitreous patch of the hind wings.

The general colour is dark fulvous, the middle portion of the wings being darker than the base and apex. The front of the thorax is marked by a narrow transverse white line, and there is a broader transverse one across its hind part, connected with a white streak running in a continuous line along the hind margin of the fore wings for about one quarter of their length, where it forms a strong angle and runs nearly to the costa; it is outwardly edged with black, this is succeeded by the large vitreous patch in the centre of the wings, of a triangular form, the side towards the base of the wing being rather emarginate; and its apex rests upon a white undulated striga running across the wings, edged within with black, beyond which the wing is much irrorated with pale and grey scales, especially towards the costa; near the tip of the wing is a black crescent, and a patch composed of three small black spots in a triangle, on a fulvous ground, preceded by a curved white line; the margin of the wing is ashy buff, traversed by a very slender, very much waved black line.

The hind wings have a similar-sized vitreous patch in the middle, its basal edge being nearly straight, preceded by an arched white line, outwardly edged with black and connected towards the costa with the strongly-waved white line (inwardly edged with black) on which the apex of the vitreous patch rests, the ashy buff margin of the wing bears a series of small black spots, followed by a very slender waved black line.

On the underside the wings have the base of a rich darker brown colour (extending as far as the undulated transverse striga), the apical half of the wings (as well as the costa of the hind ones) being much paler.

The antennæ of the males are not very broadly feathered; they are 32-jointed, each joint emitting four branches of equal length, except about eight of the terminal joints, in which one of the pairs of branches gradually diminishes in length, and becomes obsolete in two or three of the terminal joints. The antennæ of the female are less strongly feathered, and one of the pairs of branches becomes obsolete in about seven of the terminal joints.

Saturnia Zacateca, Westw. *S. alis valde angustis subfalcatis nigris, omnibus macula maxima vitrea, anticis striga basali geniculata alba, ad apicem fulvo, castaneo griseoque variegatis, fascia interrupta alba extus rufescenti, posticis nigris, prope marginem posticum fascia interrupta alba extus castaneo-rufa, margine postico griseo variegato.* ♂

Expans. alar. antic. unc 3$\frac{6}{8}$.

Hab. in Bogota, Americæ Meridionalis. In Mus. Hope.

This curious species is at once distinguished by its very narrow wings and the large size of the glassy spots, especially in the hinder pair, the body is black, with a white ring round the neck and a less distinct fascia across the hind part of the thorax. The antennæ are very strongly branched, the fore wings are especially long and narrow and slightly falcate at the tip, which is rounded, they are of a black colour, slightly tinged with chestnut, and powdered, especially along the fore margin, with grey scales. A narrow, straight, white striga extends from the base of the wing to the vitreous spot, where it is angulated, and runs towards the fore margin. The centre of the wing is occupied by a large, elongated, suboval heptagonal vitreous spot, which is not traversed by any transverse vein, the branches of the median vein being pushed so far backward, as to admit of its occupying so large a clear space; a narrow white fascia extends from its extremity to the costa, and from the middle of its hinder margin to the hind margin of the wing, the space between which and the apical margin is varied with chestnut, red and grey scales and luteous patches. The tip of the wing is orange, with a chestnut patch and a white angulated line, below which is a large oval chestnut-red patch, bearing a black spot and divided into several parts by dark luteous lines. The hind wings are almost entirely occupied by a large oval glassy patch destitute of veins, the subcostal vein being pushed towards the costal margin, and the median one towards the anal margin, and their branches emitted at an unusual distance from the base of the wing; the apical portion is coloured in the same way as in the fore wings, except that the luteous spots form a narrow, continuous, submarginal fascia, enclosing a series of transverse, black spots more or less united in pairs.

Saturnia Jorulla, Westw. *S. alis fulvo-fuscis, anticis macula subtriangulari, posticis macula subovali, vitreis albo nigroque marginatis, striga angulata e basi ad costam anticarum, alteraque multidentata (communi) pone medium albis nigro roseoque marginatis; striga tenui, nigra, undata, subapicali, macula tripartita, nigra versus apicem connexa, posticis serie submarginali macularum rosearum, extus linea undata, nigra e margine griseo separata.* ♂ ♀

Expans alar. antic. maris, unc. 4.

Hab. in Mexico, Cuantla. E folliculo in mense Octobris invento imago prodiit Augusto sequente. Communicavit D. Coffin. In Mus. Westwood

This species is allied to *Saturnia Hesperus* (Cramer, pl. 68. fig. A), but is smaller, and has the dentated fascia of the fore wings extending in a straight line entirely across them, it is also much more brightly coloured Both sexes have the fore wings emarginate along the outer margin, those of the female being rather less so than those of the male. The general colour of the wings is tawny brown, the fore wings with the fore margin thickly clothed with grey scales being white towards the base, the front of the thorax has a continuous white band; another extends also across the hind part of the thorax, and is continued by a white bar along the wing for about one-third of its length, where it is angulated, and extends nearly to the costa; it is inwardly edged with bright rosy, and outwardly in part with black; the vitreous patch which occupies the middle of the wing is subtriangular, having a narrow white margin succeeded by a wider black one. This spot is followed by a multidentate white striga, edged with black on the inside and with rosy red on the out, running nearly in a straight direction across the wing, and extending also in a curved one across the hind wings to the anal margin. This striga is followed in both wings by a rather wide space much powdered with grey atoms, except towards the costa, which is more ashy coloured; the dull luteous margin is traversed by a slender, waved, black line, followed by a white band, and towards the tip of the fore wings is a black patch, outwardly dentate, succeeded by two smaller black ones edged with tawny, and a short curved and dentated white line extends to the tip of the wing.

The hind wings are very similar to the fore ones, having near the base a slightly curved white streak outwardly edged with black, followed by a nearly oval vitreous spot, edged with white and black, slightly larger than the spot of the fore wings; and the luteous margin of these wings bears a slender wavy black line, preceded by a row of small rosy and black spots.

The wings on the under side are coloured exactly as on the upper, except that the costa of the hind wings is narrowly white. The antennæ of the males are but moderately feathered: they are about 30-jointed, each joint producing two branches of equal length on either side, except that in the eight or nine terminal joints one of the pairs of branches is gradually obsolete, being entirely wanting in the six last. The antennæ of the female resemble those of the male, but are rather less strongly feathered.

Saturnia Lavendera, Westw. *S. alis flavis, basi obsolete fusco-strigosis, omnibus ocello parvo ovali (fere æquali) livide carneo, medio vitreo, nigro tenue cincto, anticis pone medium strigis duabus tenuibus undulatis valde obliquis, fascia lata fulvo-brunnea extus undulata maculaque parva nigra subapicali, posticis striga ante medium integra, alteraque pone medium dentata nigris serieque subapicali lunularum fulvo-brunnearum.* ♀

Expans. alar antic fœm. unc. 4¾.

Hab. in Mexico. E larva magna viridi spinosa mense Junio in truncum populi capta imago mense sequenti producta. Communicavit D. Coffin. In Mus. Westwood.

Of this handsome species I am only acquainted with female specimens, varying in the more or less golden yellow tint of the ground colour of the wings, which are thickly irrorated with small blackish scales. The anterior pair have the fore margin (as well as the front of the thorax) grey. They are rather dusky near the base and next the costa. There is a dusky spot followed by a short transverse black bar, which is connected with a scarcely distinct waved oblique striga extending to the inner margin. In the middle of the wing is an oval rosy-liver-coloured ocellus, the centre vitreous, surrounded by a black ring, resting on the outside on a very oblique waved black line, which is followed by another, broader but rather less waved, and this is succeeded by a broad space of reddish brown irrorated with grey scales, deeply scalloped along its outer margin. Near the tip of the wing is a black spot, below which is a slender black longitudinal line.

The hind wings are rather dusky at the base, with a nearly straight blackish streak running across them rather before the middle. The ocellus on these wings is sometimes rather larger than that of the fore wings, and in other specimens is united with the transverse blackish bar; beyond the ocellus is a slender dentated blackish line, followed at a short distance by a second, less distinct, and which forms the fore margin of a row of submarginal broad reddish brown lunules.

The antennæ of the females are but moderately feathered; they are 31-jointed, each joint only producing a single branch on each side, the place of the two wanting branches being indicated by two minute bristles in their stead; the branches gradually decrease in length, from about one-third of the length of the antennæ to the tip.

Saturnia Calleta, Westw. *S. alis nigricanti-fuscis, omnibus in medio macula angulata strigaque communi integra inter medium et apicem albis notatis, anticis striga angusta angulata versus basin, ocello nigro extus ferrugineo serieque lunularum nigrarum sub-*

apicalibus ; posticis serie subapicali macularum nigrarum lineaque tenui undata nigra. ♂ ♀

Expans. alar. antic maris, unc. 4¾ ; fœminæ, unc. 5¼.

Hab. in Mexico. E pupa mense Augusti producta. Communicavit D. Coffin. In Mus. Westwood.

This very distinct species is at once distinguished by the black-brown colour of its wings, marked in the place of the ordinary ocellus with an angulated white mark, like a wide prostrate V. The female is considerably larger than the male, and has broader wings, the anterior being nearly straight along the apical margin, and the hind ones shorter and wider. The thorax has a pale fleshy coloured fascia in front, and the hind part has a less distinct one of dull fulvous; towards the base of the wing is an angulated white striga, and all the wings are marked in the middle with the above-mentioned angulated white mark, half way between which and the outer margin of the wings is a white fascia with the edges entire, rather wider in the hinder wings, followed by a space which is much irrorated with grey and fulvous scales, especially in the hind wings, but becoming more uniformly ashy towards the costa of the fore wings This space incloses in the fore wings ten slender black lunules arranged in pairs, each pair united together above by a more strongly marked black lunule, edged towards the apical margin with white. The anterior pair of lunules is followed towards the costa by a black ocellus bearing a slender white arched line, and outwardly bearing a broad ferruginous border, and next the apical angle are two white arched lines resting in the middle on a ferruginous patch, the dull luteous apical margin inwardly becomes paler, and is preceded by a slender waved black line, the uniformly dull luteous margin of the hind wings bears a row of small black oval spots, followed by a slender slightly-waved black line. The underside is coloured and marked as above, except that the subapical markings are all more clearly defined.

The antennæ of the males are deeply feathered; they consist of about 30 joints, each emitting a pair of setose branches on either side, except the six terminal joints, which are extremely short, each only emitting a single very short branch on its upper side. In the female antennæ the branches extend (gradually diminishing in length) to the tip, but in the eight terminal joints one of the branches on each side becomes gradually obsolete, being quite wanting in the five terminal joints.

Saturnia Chapata, Westw. *S. alis roseo-fulvis anticarum costa colloque griseis, omnibus ocello medio, magnitudine mediocri, æquali, medio vitreo, intus hepatico, extus flavo, circuloque fusco cincto ; anticis striga recta valde obliqua pone medium fusca, macula parva nigra subapicali adjecta.* ♂

Expans. alar antic. maris, unc. 4⅛.

Hab. in Mexico. Communicavit D. Coffin. In Mus. Westwood.

My unique specimen of this species is a male, and having been reared from the larva, its hind wings are not quite fully expanded. The fore wings are more strongly falcate than in any of the other

Mexican species described in this article. The ground colour of all the wings is a rich rosy fulvous, with slight brown shades across the middle of the fore wings. The fore margin of these wings, as well as the front of the thorax, is greyish; half way between the base and the middle is a very ill-defined and irregularly angulated dusky striga, in the middle of all the wings is a moderate-sized oval ocellus, being of the same size in all the wings, the centre vitreous, the anterior part being liver-coloured, and the outer part gradually yellow, surrounded by a narrow dusky circle, half way between the ocellus and the apical margin runs a straight but very oblique dusky striga, extending from rather beyond the middle of the hinder margin nearly to the apex of the wing, where it is dilated into a small black patch. The hind wings have a more rosy tint, with a transverse, very ill-defined, dusky striga a little in front of the ocellus, and there is a slender undulated dusky striga half way between the ocellus and the hinder margin.

On the under side the wings are rather more ashy in their general colour, and the dusky stripe between the base and the ocellus in all the wings is better defined; across all the wings there is a central cloud of tawny running through the ocelli, which are smaller on this side than above, and beyond these marks is a very slight and slender row of dusky scallops, the subapical margin of the fore wings is more tawny, especially towards the hinder angle. The antennæ are fulvous and broadly feathered, consisting of about 30 joints, each emitting two branches on either side.

Saturnia Sapatoza, Westw. *S. alis supra viridi-sulphureis, nigro-atomosis, anticis in mare subfalcatis; omnibus lunula vitrea mediocri, æquali, anticis fascia obscura parum undata inter basin et medium, alteraque undulata inter lunulam et marginem apicalem; puncto nigro subapicali, posticis striga transversa media lunulisque subapicalibus obscuris.* ♂ ♀

Expans. alar. antic. unc $3\frac{1}{8}$.

Hab. in Bogota. In Mus. Britann.

This beautiful species is one of the smallest of its tribe, and is well distinguished by its peculiar colour and by the form of the lunate vitreous patch, of nearly equal size on all the wings. The wings are sulphur-yellow-coloured above, the disk covered with minute black scales, which give it a greenish tinge; fore wings with the extremity slightly falcate in the male, more regular shaped in the female, brownish buff, with a small subapical black oval dot, edged behind with an angulated white line. All the wings marked rather beyond the middle with a lunate vitreous spot, of equal size in all the wings, narrowly edged with black and with a slender curved vein (uniting the lower branch of the subcostal with the upper branch of the median veins) running through the centre of it, the fore wings moreover with a slightly waved dusky fascia before the middle and a slender waved subapical dark striga (much more strongly marked in the female than in the male), adjoining which, on the outside, is a narrow wave, paler than the ground colour of the wing, the terminal portion of the wing being duller coloured than the disc, and irrorated in both sexes towards the hinder angle with brown scales. Hind wings entire along the outer margin, with a nearly straight dusky striga running across the centre a short distance preceding the vitreous lunule, with a slender waved lilac-brown striga half way between the lunule and the outer margin, and with a series of submarginal brown curved streaks, followed by patches of flesh-coloured scales On the underside the male has the wings chestnut-grey, the disc more strongly suffused with red, with the striga and waved lines of the upper side slightly indicated, the female on the underside is greyish buff slightly shaded with brown, especially in the middle, with the dark markings of the upper side slightly indicated, the legs flesh-coloured. The antennæ of the male are short and about 26-jointed, each of the joints (except two or three at the tip) emitting four long branches. The female antennæ are 25-jointed, each joint emitting a short branch on each side at its extremity The female has the branches of the antennæ shorter than those of the male.

Saturnia Janeira, Westw. *S alis anticis apice acuminatis brunneo-ferrugineis, striga sub-basali interrupta lutescenti, ocello fusco luteo-annulato strigaque nigra e medio marginis interni ad apicem extensa ; posticis supra castaneo-rufis, margine postico fusco ocello magno concolori maculam ovalem nigram includente fulvoque extus annulato.*

Expans. alar. antic unc $3\frac{3}{8}$

Hab. apud Rio Janeiro, Brasiliæ. In Musæo Britannico.

This species is at once distinguished by the singularly acute falcated form of the fore wings, which peculiarity is probably less strongly marked in the female; supposing as I do that the unique specimen in the British Museum is a male, although the comparatively narrow antennæ might seem to indicate the opposite sex. The fore wings on the upper side are dark rich red-brown, the apical margin being dark ashy They are marked near the base with a much-interrupted and slightly-indicated luteous striga; in the middle is a moderate-sized oval ocellus, dark brown, surrounded by a slender ring of pale luteous scales, and with a very small greyish white lunule in the middle; beyond the ocellus is a regular black line running from the apex to a little beyond the middle of the inner margin, where it is marked with a few pale scales. Hind wings on the upper side rich chestnut-red, with the outer margin brown, and clothed with brown hairs along the anal margin, in the middle is a large ring of black, outside of which is a slender circle of fulvous scales, and in the centre is a rather small oval black spot crowned with a slight white lunule. On the under side the wings are dark fulvous-red, with a dusky apical margin, the fore wings with a black central circular spot inclosing a white dot, and the hind wings with a minute white transverse dot visible on the upper side in the centre of the large ocellus. The antennæ are short, 26-jointed, each joint (except three or four of the terminal ones) emitting four moderately short branches, gradually shortening towards the tip.

This species seems to approach near, if indeed it does not belong to the subgenus *Hyperchiria* of Hübner (Verzeichniss, p. 155), *Io*, Boisduval, the species of which are especially American. The transformations of one of the species (*Saturnia Metzli* from Mexico) have been recently illustrated by M. Sallé, in the 'Revue de Zoologie,' 2nd series, tom. v (1853) p. 171. pl. 5.

SATURNIA? PLUTO, Westw. *S. alis luridis, cinereo-fuscis, fusco badioque transversim subfasciatis, absque ocellis et lunulis vitreis, anticis sub apicem emarginatis; posticis elongatis et in caudam latam mediocrem extus oblique extensam, productis.*

Expans alar antic. unc 5.

Hab. in partibus calidioribus Americæ Meridionalis, Venezuela. In Mus. Westw.

The general colour of the wings of this species is dark brown, with a purplish leaden kind of gloss, the fore wings are traversed towards the base (which is of a rich chestnut colour) by two nearly straight chestnut fasciæ, followed by a shorter one of the same colour covering the transverse veinlets at the extremity of the discoidal cell, a short distance beyond which is another straight fascia of the same colour, half way between which and the tip of the wing are two dull sooty fasciæ, diffused towards the costa, and condensed in the middle of the wing into two closely approximated strigæ, beyond the outer of these strigæ the broad margin of the wing is chestnut-brown, the spaces between the veins being of a greyer tint, the hind wings are of a more uniform brown colour, with a broad darker brown central fascia, and the wide outer margin redder brown, preceded by a greyish cloud. The fore wings are somewhat falcate, being truncate at the tip, with a rather deep emargination below the extremity, the hind wings are elongated, the anal angle rounded off, and the outer margin is produced into a wide tail three-quarters of an inch long, extending outwardly; the outer margin between the tail and the outer angle has two moderately deep and wide emarginations. The body is small and slender, of an uniform greyish brown colour, without a distinctly coloured grey fascia in front of the thorax.

The antennæ in the only specimen I have seen (which I believe is a female, notwithstanding the slenderness of the body) are rather short, and composed of forty-two short joints, each producing two short pectinations on each side; these pectinations gradually decrease in length from the base to the extremity, where the antennæ are quite thin and acute. The palpi are rather broad, and the spiral maxillæ are distinct, but very slender and weak.

The costal vein of the fore wings extends about three-fifths of the length of the costa; the postcostal vein emits a branch at about one-third of the length of the wing, which runs close behind the costal and beyond it almost to the tip of the wing; the discoidal cell extends rather more than one-third of the length of the wing; it terminates transversely, the postcostal vein emitting a second branch at its anterior termination, this second branch is furcate at a short distance beyond the cell, the upper division of the fork extending to the tip, the lower division to the outer margin below the tip, and the postcostal itself extending to the upper angle of the emargination below the apical truncature of the wing; the transverse vein closing the discoidal cell emits a vein from its centre, and joins the third branch of the median vein at a short distance beyond its origin; the hind wings have the branches of the median vein arising near the anal margin of the wing, and the discoidal cell is closed by a very oblique veinlet, which emits a vein above its middle, which vein extends to the anterior extremity of the tail of these wings.

SATURNIA THIBETA, Westw *S. alis anticis flavis, squamis griseis, præsertim pone medium, variegatis, striga angusta valde obliqua prope basin; omnibus ocello fere æquali, ovali, medio, extus fulvo, puncto nigro incluso, pone medium lineis duabus contiguis valde undulatis, macula parva nigra obliqua strigaque carnea obliqua contigua, subapicalibus, posticis basi subcarneo, medio flavo variegatis, striga arcuata inter basin et medium lineisque tribus obscurioribus pone ocellum, fascia lata submarginali griseo-fusca lunulisque fulvis externis.* ♂

Expans. alar. antic. unc 5

Hab. Thibet. In Mus. Westwood.

This species is closely allied to the *Sat. Simla*, Westw., figured in the 'Cabinet of Oriental Entomology,' pl. 20. fig. 1, but differs both in the colour and the position of the markings. The fore wings are yellow, much varied with grey scales, especially at the base of the costa and beyond the middle: at a short distance from the base a slender red striga runs very obliquely across the wing. In the middle of all the wings is a moderate-sized oval ocellus, with a small black dot in the middle, marked on its inner edge with a curved white line, the outer part being liver-coloured, edged with a black ring. Outside the ocellus the wings bear a darker fulvous, ill-defined, very oblique fascia, followed by two slender very strongly undulating dark lines, the undulations being much stronger towards the tip of the wing, where the outer one is connected with a white curved line, like a U, which ends on the costa in an oval black patch, and is bounded on its outside by a slender rich red-brown line, parallel and near the apical margin is an interrupted slender black striga, followed by a row of submarginal fulvous oblong spots. The ocellus of the hind wings is preceded by a curved dark brown line, and is followed by three slender very much undulated lines, the two next the ocellus being chestnut and the outer one black; beyond the last is a broad greyish fascia edged outwardly with a slender interrupted black line, followed by a row of fulvous oblong sublunulated spots. Beneath the wings are similarly marked but more uniformly coloured, being fulvous buff without the grey scales.

The antennæ are about 32-jointed, each joint emitting two branches on each side, the branches of the central joints being moderately elongate and gradually diminishing in length to the tip of the antennæ. The body, legs and antennæ are fulvous yellow, the front of the thorax with a grey band.

Saturnia Melvilla, Westw. *S. alis sulphureo-fulvis, anticis versus basin obscure angulato-fasciatis ocello parvo medio rotundato in medio vitreo carneo biringulato, fascia lata subcinerea intus striga undata fusco-ferruginea et extus serie macularum ejusdem coloris inclusa, posticis ocello minimo cæco carneo, fascia subcinerea versus costam obliterata similiter inclusa.* ♂

Expans. alar. maris unc. 4¼.

Hab. in Melville Island. In Mus. Hope.

This species agrees in the general orange colour of its wings with *S. Lavendera*, as well as in the small size of the round ocelli in the middle of all the wings, but the slightly ashy fascia on the wings, between the ocellus and the apical margin, is much more uniform in width and nearly straight; the fore wings are slightly but acutely hooked at the tips, the fore margin is ashy-coloured, as is also the fore margin of the thorax, in the middle of the discoidal cell is a scarcely distinct light-brown angulated fascia, which is continued (although much nearer the base) across the wing to the inner margin, being also angulated in this portion; in the middle of the wing is a small round ocellus, the centre being vitreous, edged with bright red, succeeded by a ring of buff, which is surrounded by another slender ring of red; at a short distance beyond the ocellus is a reddish brown undulated striga running across the wing, nearly parallel with the apical margin, the waves following the same direction as in *S. Lavendera*, and not as in *S. Jorulla*, this striga forms the inner margin of a moderately wide greyish fulvous space, which is inclosed on its outside by a corresponding row of reddish brown lunular spots, the one next the costa being the widest; the moderately wide apical margin is uniformly pale orange. The hind wings have a very indistinct curved fascia at some distance from the base, darkest next the anal margin, as is the case with the other markings of these wings. The central ocellus is not above half the size of that of the fore wings; the centre consists of a small round bright claret-red dot inclosed within an orange ring, and this within a very fine red one. This is followed by a rather strongly dentated striga of reddish brown, followed by a row of small lunular spots of the same colour, the inclosed space being irrorated with grey atoms.

The antennæ are fulvous-red and broadly feathered.

LINNÆAN SOCIETY.

April 4, 1854.—Thomas Bell, Esq., President, in the Chair.

Read a paper entitled "Remarks relative to the Affinities and Analogies of Natural Objects, more particularly of *Hypocephalus*, a genus of *Coleoptera*." By John Curtis, Esq., F.L.S. &c.

Mr. Curtis commences his paper by a reference to the numerous attempts made of late years to establish a perfectly natural system, which, he believes, will never be attained. In our progress towards the establishment of such a system, we are sure to find disturbing forces, producing aberrant types of form, which, like discordant notes in music, will not chime in anywhere; and to this description of animals belongs the anomalous beetle, exhibited by Mr. Adam White at the last meeting of the Society, which resembles so many individual members of different families, yet agreeing with none, that it has from its first discovery been a subject of speculation, in which M. Desmarest, Dr. Gistl, Dr. Burmeister, M. Guérin-Méneville, and Mr. Westwood have taken part. M. Desmarest considered it as allied to the *Silphidæ*, and Dr. Burmeister and Mr. Westwood are agreed that it is related to the *Cerambycidæ*; but after a careful investigation Mr. Curtis is constrained to believe that it is more nearly allied to the *Lamellicornes*. With the view of showing this to be the case, he contrasts the leading characters of the *Lamellicornes* and *Longicornes*, and particularly compares the genus *Hypocephalus* with those members of both families to which it offers either affinity or analogy, and in particular with *Cyrtognathus*, with which Mr. A. White had especially associated it. He admits that there is a very considerable analogy between *Hypocephalus* and *Cyrtognathus*, but observes that if we look to the antennæ of the latter having 12, instead of 11 joints, to their great length and relative proportions, as well as to the situation, form, and magnitude of the eyes, the size and figure of the thorax, the scutel, sternum, and elytra, having wings for flight, to the long sprawling legs, neither robust nor truly 5 jointed, to the long simple tibiæ, the dilated and bilobed and spongiose tarsi, it is impossible to allow that there is any affinity. *Cyrtognathus* is a Longicorn, *Hypocephalus* is not. The author then gives a detailed description of *Hypocephalus armatus*, Desm.?, observing at the same time that there are so many differences between M. Desmarest's figure and Mr. Turner's specimen, examined by him, that they are, in all probability, if not distinct, of different sexes. From the peculiarities of its structure Mr. Curtis proceeds to deduce the probable habits of the insect, of which little is known from actual observation, and concludes by some further observations on its proper place in the system. In the course of these remarks he maintains the great importance of the tarsal system of Geoffroy, as adopted by Latreille, as a basis for the primary divisions of the *Coleoptera*, and explains the nature of the exceptions which occur in several groups to the general type of development in this particular. He particularly alludes to the supposition that the so-called *Tetramera* are really pentamerous; but maintains that the portion considered as a fourth or extra joint, even when articulated, is not the analogue of the fourth joint of the *Pentamera*, but merely a head or fulcrum at the base of the terminal joint, which is rendered necessary from the third joint being bilobed and cushioned beneath. He does not, however, insist that *Hypocephalus* is a Lamellicorn; all his claims for it are based on its being truly pentamerous, which draws it nearer to the *Lucanidæ* than it can possibly be attracted to the *Cerambycidæ* by any less important character. He begged, however, that he might not be misunderstood as wishing to detract from the value of the structure of the mouth in the formation of systems, for although it may be subject to great modifications, and depart from the typical forms like the changes in the tarsi, such anomalies are perhaps confined to the minuter members of a family, and a comparison of the trophi is unquestionably of the greatest importance in arriving at the true affinities of insects.

The paper was accompanied by drawings of *Hypocephalus* and its details, and also of the details of *Cyrtognathus*

June 6.—Thomas Bell, Esq., President, in the Chair.

Read the following extracts from a Letter from Dr Frederick Welwitsch to Richard Kippist, Esq, Libr L.S, translated from the German, and communicated by Mr. Kippist

St Paul de Loanda, Tropical W Africa, S. Lat. 8° 48′ 5″.
March 2nd, 1854.

My dear Friend,

Although I have now been above seven months in Africa, it is only to-day that the first opportunity has occurred of sending letters direct to London, and even of this opportunity I received such short notice that I have only time to send you a few hasty lines of news You must not therefore be surprised, if this, my first African letter, proves somewhat confused, since I returned to Loanda only yesterday evening, from an excursion into the interior, and find myself so surrounded by pressing occupations of all kinds, that I scarcely know where to begin.

My journey from Lisbon here was so far favourable that it gave me a good opportunity of becoming acquainted, superficially at least, with the flora of Madeira, St. Vincent's (Cape Verds), St. Jago, Sierra Leone, and the incomparably lovely Ilha do Principe. In Sierra Leone I staid nine days, and bethought me, with each new plant I encountered, of our old friend George Don.

What astonished me more than anything else at Sierra Leone was the circumstance that the English, who have now been so long in full possession of this charming territory, nevertheless still remain in utter ignorance of the adjoining negro-district, more particularly with respect to the interior of that part of tropical Africa.

In Sierra Leone I saw the first parasitical *Orchideæ*, and almost always in company with a gigantic species of *Platycerium* (*P alcicorne*?) [P. Stemmaria, *Desv*]

In Prince's Island I wandered, while climbing the highest peak (Pico de Papagaio), for a whole hour among flowering examples of *Caladium bicolor*, and many other splendid tropical species, which are not to be found in Sir W. Hooker's recently published 'Flora Nigritiana.' Of *Filices* alone I collected about Free-town in Sierra Leone, and on Prince's Island, above twenty species, mostly gigantic forms; among them a *Gleichenia* (anne *Gl. Hermanni*, R. Br ?), " stipite scandente sæpiùs 25-pedali "

I arrived in Loanda (Saõ Paulo de Loando), the capital of Angola, in the beginning of October 1853, and since that time I have not lost a moment, but my whole time has been employed in excursions; so that I have already become acquainted with and plundered upwards of forty miles of coast, from the Guizembo River (three miles N. of Ambriz) to near the mouth of the mighty Cuanza (about 9° 30′ S. Lat.), and possess the materials for a Flora of Loanda, of five to six * miles in circumference, in well-preserved specimens.

The total number of plants which I have hitherto collected, as well on the islands as in Sierra Leone and Angola, may amount to about 800 species, but increases daily as the rainy season approaches, all those hitherto collected having been obtained in the dry (and therefore unfavourable) season. March and April are here in Angola the rainy months, and the period of the highest and most luxuriant development of vegetation falls in the months of May and June, so that I have good right to hope that my collection may very shortly be increased to, perhaps, more than double its present amount, since the annual species, as a matter of course, make their appearance only in the rainy season

What especially surprises me here, with respect to the geographical distribution of certain genera, is the occurrence of three or four *Aloes*, of a *Stapelia* (*Heurnia*), and several other Cape genera. Of *Euphorbia* I have already found near Loanda a gigantic species, with a stem 2½ feet in diameter and upwards of 30 feet high, forming woods, as the *Pinus sylvestris* does with us! This species, which is readily discernible even from ship-board, is not noticed in the 'Flora Nigritiana.'

In the lakes of the interior, distant about one to three German (four to twelve English) miles from the coast, I have found almost everywhere magnificent Nymphæas (*N cærulea, micrantha, dentata*, &c.) and *Pistia*; and in addition, our *Typha angustifolia* and *Scirpus maritimus*.

Of trees, there occur in the dry coast-flora only *Adansonia*, *Sterculia*, n. sp, an *Afzelia*, *Eriodendron anfractuosum*, and a *Bauhinia*, with three species of Palm. on the rivers, however, the tree vegetation becomes more dense, and more abundant in species; the list being then augmented by *Avicennia africana*, *Laguncularia racemosa*, and *Rhizophora Mangle*; of which, the *Laguncularia* always remains a shrub, but the other two sometimes appear as great trees. A *Capparidea* too, the beautiful *Mærua angolensis*, DeC, appears as a tree, even in the neighbourhood of Loanda, but extremely seldom: usually only as a shrub 5–6 feet high. Among my collections several species of *Strychnos*, and another *Loganiacea*, likewise occur, most of which may probably prove to be new species. In the woods of Euphorbia (*Candelabra*, n. sp.) is found a wonderfully beautiful terrestrial *Orchidea*, with a scape 4–5 feet high, which ends in a spike of a foot long with large yellow flowers. A truly magnificent *Crinum* (*Broussonetii?*) luxuriates in boggy places; and on hilly slopes, the *Adansonia digitata* is nearly covered by a glaucous-leaved *Loranthus* with deep red flowers.

It is much to be regretted that excursions in this country are attended with so much expense, and such great inconveniences of all kinds. Although the Portuguese Government allow me £45 per month, I shall nevertheless be under the necessity of contracting heavy debts before I return to Europe, since everything is at least three times dearer here than in London. As there are few roads, and fewer beasts of burden, all baggage, provisions, water, presses, paper, beds, cooking utensils, with the necessary articles for barter (*e. g.* guns, powder, brandy, cotton goods, glass-pearls, &c.), must be conveyed on the heads of negros, so that even the shortest excursion of three or four days costs an enormous sum.

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* Q^{r} German miles = 4½ English.

Meanwhile my reliance is upon England; that is to say, I anticipate that my cases of living plants, insects, seeds, &c., as also a few herbaria of the flora of this neighbourhood, will be duly honoured; and in that hope, I intend within two or three weeks from this time, to make up a sample-collection for London. About the 16th or 18th of the present month, the English ship of war Penelope will leave here for England, and I shall avail myself of this opportunity to send living plants, as well as seeds and *Hymenoptera*, to Messrs. Wilson Saunders, Hooker, &c.

Read also a paper "On a new species of *Anomourous Crustacean* belonging to the family *Homolidæ*, found by Mr. Wm. Lobb, at Monterey in California, in the winter of 1850" By Adam White, Esq., F L S. &c.

This species Mr. White stated to be in some respects allied to *Lithodes* (*Echinocerus*) *cibarius* from the Columbia River, but to differ from it in the more regularly triangular and depressed form of the carapace, and in the outer antennæ having two or three beautiful petaloid processes at the base, instead of the strong thorn-like spines at the base of the other. The abdomen is singularly pitted on the under side; the surface of the carapace is covered with strawberry-like tubercles, and the thick spines with which the legs are covered are similarly ornamented. The most singular character however is the absence of the hinder pair of legs, or (as the President suggested) their apparent absence, there being no hole between the carapace and abdomen through which these appendages could come.

Mr. White gave a revision of the species of *Lithodes*, which had been much added to, since the work of Prof. Milne-Edwards, by a Japanese species described by De Haan; three species from Fuegia, obtained on the voyage of Dumont D'Urville; one described by Edwards and Lucas; another by Dana; and another by Mr. White himself. He proposed for the fine species obtained by Mr Lobb, the name of *Lithodes* (*Petalocerus*) *Bellianus*, in compliment to the President of the Society.

Read also a Memoir "On the External Membrane of the Unimpregnated and Impregnated Ova of the Common Salmon." By John Hogg, Esq., M.A., F.R.S., F.L.S. &c.

In illustration of his paper, Mr. Hogg presented to the Society two phials containing (preserved in spirit) mature ova as they fell from the female Salmon unimpregnated, and others taken at the same time and artificially impregnated. They were taken by Mr. Harrison in December last, and sent to Mr. Hogg in January by Isaac Fisher, Esq. of Richmond, Yorkshire "The ova in both phials," says Mr. Harrison, "were taken from one fish in the River Tees, on the 27th of Dec 1853. The female fish was held up by the head, and when the spawn was ready it run out by itself. The ova were with the milt for about half a minute, or as soon as they could be got away. The impregnation naturally takes place in a moment, as is always the case in a stream, where the milt shed in the running water passes rapidly over the ova." Mr Hogg was unable to obtain either the immature ova from the same female, or ova naturally fecundated —two other conditions which he was desirous of examining to complete the series of his observations

The object which Mr Hogg had chiefly in view was the microscopic examination of the external membrane of the ovum in these several conditions, in relation to the statements made by different authors as to its structure and the changes it is supposed to undergo. Thus in the 'Book of the Salmon,' by Messrs Fitzgibbon and A. Young (Lond 1850), it is stated (p. 183), that "the eggs of that part of the roe nearest to the vent will be always found of larger size than those situated higher up in the stomach, they are softer also, and their outward filaments (or membranes) are thinner and more porous, and thus they are fitter for impregnation—for absorbing the milt of the male as it is poured over them." And again, p 185, "Although the unripe ova should be expressed, they would be useless for production, for their absorbing pores are still closed against the interpenetration of the milt, and consequently in this state impregnation is impossible" In like manner Mr. Jacobs, in a communication published in the 'Hanover Magazine' for the year 1763, quoted in Yarrell's 'British Fishes' (ed 2nd, vol. ii. p. 93), says of the common Trout and of the Salmon also, "After an egg has been fructuated by the sperma of the male, which slips through an invisible opening into it, it lodges in the white liquor, under the shell and round the yolk." Recent discoveries, Mr. Hogg continues, have shown that the fecundating principle of the male fish (as of every animal in which there is a sexual communion) is solely derived from the seminal animalcules or spermatozoa. In the words of our late distinguished Fellow, Mr. Newport, "The spermatozoa alone, in all cases of communion of the sexes, are the sole agents in impregnating the ovum, and impregnation cannot be effected by the *liquor seminis*" (Phil. Trans. 1851, p. 172). Dr. Martin Barry indeed has asserted (Phil. Trans. 1840, p. 533, and pls. 22 & 23 figs 164–169) that he had observed an attenuation, or an orifice like a cleft, in the thick transparent membrane of the ovum of the Rabbit, at the period of, and after, fecundation, through which the spermatozoa enter; and in a recent communication to the Royal Society (Proceedings, vol. vi. p. 335), the same author has referred to a lately published work by Dr. Keber, in which Dr. Barry states, "That physiologist describes the penetration of the spermatozoa into the interior of the ovum, in *Unio* and *Anodonta*, through an aperture formed by dehiscence of its coats, analogous to the micropyle in plants." On submitting portions of the external membrane of both the unimpregnated and impregnated ova of the Salmon contained in the two phials presented to the Society, to the Society's microscope, Mr Hogg was unable to detect any perceptible difference between them, even when magnified with a considerable power. The membrane in both conditions was a perfectly transparent tissue, and appeared, to Mr. Kippist as well as to himself, to be entirely plain; that is to say, unfurnished in both conditions with either cells or pores, or anything resembling a cleft or aperture. Examination of the entire ova from both phials with a good lens gave the same result, affording not the least appearance of a cellular or porous structure in their external membranes, or of any orifice or cleft, thus agreeing with Mr Newport's statement (Phil. Trans. 1851, p. 203), that "on careful examination of the envelopes of the frog, he had not been able to detect any fissure or orifice" In conclusion Mr Hogg refers to the most recent discovery of that lamented physiologist, which seems to set this question at rest, by showing that while spermatozoa are found "within the vitelline cavity in direct communication with, and penetrating into the yelk," they "do not reach the yelk of the Frog's egg by any special orifice, or canal, in the envelopes, but actually pierce the substance of the envelopes at any part with which they may happen to come in contact, as I have constantly observed while watching their entrance" (Phil Trans 1853, p. 271).

Read further a memoir "On the Osteological Relations observable among a few Species of the Bovine Family." By Walter Adam, M D Communicated by R. Brown, Esq., V.P.L.S.

Dr. Adam commences his Paper by referring to a communication made by him to the Society in 1831, and published in the sixteenth volume of its 'Transactions,' "On the Osteological Symmetry of the Camel," in which an attempt was made to trace, throughout one large animal, the identities and variations of osteological dimensions characteristic of a species In the present memoir he proposes, by an osteological comparison of some species in a cognate group of animals, to exemplify the more striking resemblances and deviations in form which are exhibited among the components of a zoological family. The skeletons examined were nine in number, all contained in the collection of the British Museum, and consisting of both males and females of three species, the *Bos Bantiger* of Java, the *Bibos Gaurus* of Nepaul, and the *Bison Americanus*; and of males only of three other species, the Aurochs (Bison) of Lithuania, the Caffre Buffalo of the Cape of Good Hope, and the short-horned Buffalo of the river Gambia. As in his previous paper, Dr. Adam takes as the standard of measurement the basilar length of the cranium, which, divided into 72 parts, forms the means of comparison with all the other dimensions. In conformity with this standard, he gives the proportional measurements of all the principal parts of the nine skeletons examined, with elaborate minuteness, in a tabular form, and adds also a series of tables, in which the dimensions are represented by proportional straight lines instead of figures.

June 20.—Thomas Bell, Esq., President, in the Chair.

Read an extract from a Letter dated "Santarem, 27th March, 1854," addressed to Samuel Stevens, Esq., F.L.S., by Mr. H. W. Bates, "On some Particulars in the Natural History and Habits of Termites."

"It is curious," Mr. Bates says, "that for two months before receiving your last letter, I have been attending to the *Termites*. I began first to look for M. Schiodte's new *Staphylini*, and ended by becoming greatly interested in the *Termites*, without, however, finding the *Staphylini*. Some of the results of my examination up to the present date I intend to send on a separate sheet, the specimens will follow next month. I have examined about a hundred colonies. Some of the results I have come to are,—that there are no *truly apterous imagos*; that there are only two kinds of larvæ, fighters and workers; that a large hillock is always an agglomeration of *many very distinct* species, which build with very different materials, that some species cherish only one ♀ and one ♂ adult in a colony, whilst others have a great number (50 or 100) adults, the ♂ and ♀ in about equal numbers, lastly, I have detected a very good character to distinguish ♂ and ♀ in the *pupa* and *adult* states, and have found pupæ in various stages of growth or *ecdysis*, without, however, as yet detecting the first moult from the larva to the pupa, to decide what becomes of the monstrous apophyses of the head, and the mandibles of the soldier (fighter) larva."

Read also a Letter addressed to the Secretary by Dr. George Buist, "On the Construction of the Nest of a Species of Mason-Wasp in the Neighbourhood of Bombay."

"I observe," says Dr. Buist, "that some specimens of the nest of the Mason-Wasp or bee from India were placed before a late meeting of your Society. Perhaps the following account of the habits of this curious insect may interest you; they are given from personal observation. The male of the mason-bee is about twice the size of the common wasp, but nearly of the same colours; the thin portion which unites the thorax and abdomen being nearly an eighth of an inch in length, and scarcely thicker than a horse's hair. The female is about one-eighth this size, and of a bright shining bottle-green, like a blistering fly. She bears no resemblance to the male, and they are only seen together when the eggs are being laid. Early in October, so soon as the rains are fairly over, the mason-bee begins to build. Having selected a spot for his nest, generally in some quiet corner, to which however there is free access and egress, he approaches with a piece of wet mud about the size of a pea, which he holds with his fore-feet against his breast, close up to his mouth. He first makes a neat thin ring, of about an inch in diameter, and then brings this up by successive additions until it assumes very nearly a spherical form. The opening at the crown is now drawn up like the neck of a bottle, and turned over with a flat lip, an opening being left of about an eighth of an inch in diameter. Two or three of these little dwellings, which take from six to eight hours to finish, are commonly built together and left to dry before anything more is done; the outer shell having in the process of construction been partially filled with mud, and divided into compartments, a considerable space being left open within the principal aperture which gives entrance to them all. So soon as they are firm enough, and whilst still damp, the female is seen running and flitting about them, and dropping a few eggs in each, and immediately after this the male is seen to approach the nest warily with what appears to be a cumbrous load in his arms This turns out to be a large green caterpillar, about three-quarters of an inch in length, fully the size of the bee which carries it: this is now thrust through the bottle-neck aperture into the nest. The struggles of the resisting worm being met with many a punch, nip, and dig from the inexorable bee, it seems at last to sting its victim to death. The moment it is fairly within the bottle, a little globule of mud is brought, and the mouth of it hermetically sealed More bottles in succession are built, provisioned, and sealed up in this way, till the collection consists of six, eight, or ten; when fairly completed, the builder seems to take no more heed of them: he is shy and easily frightened, and will abandon his operations and quit the house altogether if he observes anybody near. I have never happened to see the grubs or young bees, but about a fortnight after the work just described has been finished, the nests are all found to be burst through, and the fragments of the shell and casing of the chrysalis are found inside I have watched these operations frequently at Bombay, and only regretted that the pressure of other avocations prevented me from gathering more particulars than I have now given. So far as they go they may be relied on."

Read also a paper "On some remarkable Spherical Exostoses developed on the Roots of various species of *Coniferæ.*" By Joseph Dalton Hooker, Esq , M.D., F.R.S., F.L.S. &c.

Dr. Hooker states that the exostoses which form the subject of his paper were first observed by him on the roots of the *Podocarpus dacrydioides* of New Zealand, collected by the Rev. W Colenso, and subsequently at Kew, in company with the Rev. M J. Berkeley, he found similar organs to be of very general occurrence among *Coniferæ.* As examples he mentions *Araucariæ* of several species, *Podocarpi, Taxodium, Dacrydium, Thuja, Cupressus, Phyllocladus,* and *Cunninghamia.* Mr. Berkeley has described, in the 'Gardeners' Chronicle,' exostoses on the roots of the Pea, and Dr. Hooker has also been long familiar with other examples, especially with a most remarkable modification of them on the Laburnum, pointed out to him by Prof. Henslow, who has also shown him others on the Garden Bean, and on species of *Lathyrus,* both wild and cultivated, as well as on other *Leguminosæ.* Except, however, in the instance of *Taxodium distichum,* in which they have been noticed by the elder DeCandolle ('Théorie Elémentaire,' Ed. 2. p. 356), and in which they exist in a very peculiar condition, he is not aware of their prevalence in *Coniferæ* having been anywhere noted. In *Podocarpus dacrydioides*, the species selected for illustration, the roots and rootlets are studded at intervals with spherical bodies, of diameters varying between the $\frac{1}{40}$th and $\frac{1}{60}$th of an inch, either attached by a very short pedicel, or absolutely sessile, and sometimes even sunk into the bark of the root They are easily detached, leaving a small scar, are of a soft and spongy consistence, smooth and even on the surface, of a pale reddish colour, and in a vertical section are seen to be composed of—(1) a mass of spongy cellular tissue, aggregated round (2) a central vascular axis, which extends from the wood of the root to the centre of the sphere, and (3) a delicate cuticle. Each of these tissues is described in detail, and illustrative figures of the exostoses of *P. dacrydioides* and of their microscopic anatomy accompany the paper. With regard to the exostoses of the roots of other plants, Dr. Hooker observes that for the most part their structure is approximately the same as those of the *Podocarpus*, but they are very much larger in most herbaceous plants than in the arboreous, are more irregular in form, and are destitute of the vascular axis. In some species they are perennial, in others annual. In the Laburnum they form fleshy branched masses, as large as the fist, and are full of vascular tissue. Morphologically, he looks upon them as transformed root-fibrils, but regards their special function as obscure, although they may be supposed to be subservient to the office of selection of nutriment. In conclusion, he indicates a remarkable morphological analogy between them and the tubers of the root-parasite *Balanophora*, which are supplied with an abundant development of vascular tissue, mainly derived from the vascular axis of the roots upon which the *Balanophoræ* are parasitical. In this case, Dr. Hooker thinks there can be no doubt that the parasite exerts a specific or diseased action in the root-stock, which results in the development of a vascular bundle analogous to a rootlet, which is prolonged into the tuber of the parasite, and which afterwards increases greatly, branches, and resembles in its appearance as well as in its relation to the root-stock, the vascular branches occupying the axis of the branched exostoses of the Laburnum. On the subject of the development of the tissues of *Balanophoreæ*, however, he reserves further details for a monograph of that Order which he is preparing to lay before the Society.

BOTANICAL SOCIETY OF EDINBURGH.

February 8, 1855.—Professor Balfour, President, in the Chair.

Mr. T Kirk, of Coventry, sent for exhibition a specimen of *Cerastium triviale*, with the carpellary leaves partially turned inwards, so as to show distinct parietal dissepiments. The placentas were free and central. A very similar specimen is figured and described in the 'Gardener's Chronicle' (1844, p. 557), and 'Lindl. Veg. Kingdom' (p 497)

The following papers were read :—

1. "Account of a Botanical Excursion to the Braemar Mountains in August 1851," by Prof. Balfour.

The Professor gave an interesting account of his tour with his pupils and friends, and mentioned the localities of several plants observed.

2. "Report on the Diatomaceæ collected in Braemar in the autumn of 1854, by Prof. Balfour and Mr. G. Lawson," by Dr. Greville. (See page 252.)

3. "On the Geological Relations of some rare Alpine Plants," by Dr. Gilchrist.

Oxytropis campestris is a plant confined to a single isolated locality in Clova. It grows on a cliff facing the south, which is somewhat isolated from the surrounding rocks by two perpendicular indentations, which, as they are the result of weathering, indicate some change in the structure or composition of the rocks. That on which the plant grows, and to which it is limited, is a micaceous schist, extremely rich in mica, of a dark colour, and rapidly undergoing decomposition. The immediately surrounding rocks are of the same general character, but the mica is greatly less in proportion to the other materials, and lighter in colour.

Lychnis alpina is confined to a few isolated localities It grows on the summit of a hill called Little Gilrannoch, at about equal distances from Glens Isla and Dole. It seems limited to about half an acre of surface. The rock is a tabular mass of compound felspar, apparently capable of resisting decomposition. While in many places it is bare and flag-like, other portions of it present a singularly rough and irregular surface, as if the rocks had undergone fusion previous to expulsion, small portions of it bearing a distinct resemblance to similar specimens from the so-called "vitrified forts." The relations of this plant to the rock on which it grows are well seen, many of the specimens growing in little crevices of the bare rock, where there is not the slightest vestige of soil, ordinarily so called The rock, coextensive with the limits of the plant, is unvaried in character. Its relations to those around could not be ascertained

Astragalus alpinus grows upon the summit of Craigindal, a hill about 3000 feet in height To the east of Braemar we gathered specimens of this elegant little plant, in two separate localities, at a considerable distance from each other, but the rocks on which both grew were the same, a very pure compact felspar, of which the entire hill seems to be formed.

4. "Descriptions of new Coniferous Trees from California," by Mr. A. Murraw.

The descriptions were rather horticultural than botanical, and botanists must wait for some accurate and scientific definitions of them, before they can be admitted as described species.

MISCELLANEOUS.

On the Anomalous Oyster-Shell. By Prof. J. S. Henslow.

To the Editors of the Annals of Natural History.

Hitcham, Hadleigh, Suffolk, March 8, 1855.

Gentlemen,—In your Number for February, Mr Busk has invited attention to a curiously-formed valve of a shell, resembling a combination between an Oyster and a *Pholas*. He intimates, with doubt, that the oyster has somehow encased the *Pholas*, or at least that the shell of the latter is present in that of the former. I suspect, however, such may not be the case, and that Mr. Busk has the genuine shell (one valve) of an oyster only. A specimen of a fossil oyster which I prepared for the Ipswich Museum a few weeks ago, seems to explain Mr. Busk's puzzle. This shell had attached itself by the *lower* valve to an Ammonite, and, as it grew, had taken, in a very complete manner, the impression of its whorls. But the curious result has been, that the *upper* valve, which was not in contact with the Ammonite, has become partially modelled to represent it. Thus the two valves together have the double impression of the Ammonite, in intaglio below, and in cameo above. I suspect from this that Mr. Busk's oyster had grown with the *lower* valve (which he does not possess) attached to the outer convex surface of a *Pholas*; and that the upper valve (the one in question) has in consequence been partially modelled after it. We must suppose in these cases that the mollusk accommodates itself to whatever curvature is impressed upon the lower valve, and then the materials secreted for the upper valve will necessarily follow the contour thus given the animal. It may be worth while to search for oysters attached to shells and rugged stones, to see whether traces, more or less distinct, of this sort of impress be not more frequently given to the upper valves than we have suspected. I have placed the fossil specimen alluded to in a vertical position, with impressions in clay (one on either side), from the surface of each valve; that from the lower side perfectly restores the form of the Ammonite, which has been only faintly impressed on the upper. The specimen is probably a detrital relic obtained from the drift. It was purchased by R. Cobbold, Esq., many years ago, in the north of Suffolk.

I remain, Gentlemen, yours very truly,
J. S. Henslow.

Description of a New Species of Corynactis. By William Thompson.

Corynactis heterocera.

Spec. Char.—Coriaceous; the tentacula in each row varying in shape, the animal but slightly mutable.

This Corynactis measures nearly an inch in diameter, and the same in height, when in a state of expansion; when contracted it has the shape of a button and is firm to the touch, coriaceous, and of a delicate yellow colour.

The body is covered by an epidermis, which is easily detached and slimy; when this was rubbed off the animal was of a dirty white; the epidermis was replaced in a few days, when the animal recovered its colour; when portions only of the epidermis are rubbed off, it has a mottled appearance.

When closed all the tentacles are completely withdrawn.

The margin of the disk is crenated; the tentacles are placed within it.

The tentacles in the outer row are thirty-two in number; the other three rows have each two or three less, there are four rows in all. The tentacles in each row differ from the others; those in the outer row are the longest, then those of the second, third and fourth, in the order that I have named them; the third and fourth rows having the peduncles so short as to be nearly sessile. The shape of the tentacles, as I have stated, differs much. The rows of tentacula, as also the individual tentacles, closely approximate, those in the outer row diverge slightly, and, when looked at from above, bear the appearance of a finely-lobed edge to the disk, the real margin being hidden by the heads of the tentacles hanging over it. The tentacles in each row appear to the eye short, stout and capitate, those in the first or outer row have the head bilobed or kidney-shaped, and a round tubercle placed below the head on the inner side; all the tentacles are horizontal. The tentacles of the second row are of a peculiar construction, apparently uniting the capitate extremities of *Corynactis* with the elongated form of *Actinia*; the apex is a spear-shaped process, and this is seated on a peduncle formed by four globose bodies placed two and two, and divided from each other by constrictions more or less deep. In the third row the peduncles of the tentacles are very short, thick and capitate, the crown is round, rather oblong, and with a constriction at half the distance from each end, giving the crown the appearance of a figure of 8. The fourth or innermost row is short, or shorter than those in the third, they are in fact nearly sessile. The heads of the tentacles in the fourth row appear occasionally to vary, sometimes being of the same shape as those in the third row, that is, bilobed, whilst at other times they are decidedly five-lobed. The whole of the tentacula are straight, rigid, regularly disposed, and point slightly outwards. They slightly change their shape at times when the animal is opening; this however is not always the case.

The disk within the inner row of tentacles is ample.

The mouth is formed of two crenated lips, forming a straight orifice; at times this is drawn into the shape of a crescent. Whilst copying this portion of my notes, my *Corynactis* does not appear quite easy; it has thrown out its lobes, covering every part of the disk, with the exception of the crenated margin; the lobes do not rise, as in species of *Actinia*, above the margin; they are on the contrary flat and even with it, and are firm to the touch.

The colour of the animal is a delicate yellow or buff. The disk is of a pellucid white, streaked with fine radiating lines of a dead white. The tentacles of the first row are pellucid white, with the capitate extremities dead white; the tentacles in the three remaining rows are also pellucid white, in parts tinged faintly with a reddish hue; the capitate extremities have a powdered white edge. The mouth is of a darker yellow than the body.

This species does not appear to change its shape very much, thus differing from the other known British species, the only change I have noticed was that from a state of contraction to one of expansion, from the button shape to nearly a true cylinder, of pretty equal dimensions at both extremities, with a constriction immediately under the crenated margin. It easily adheres by its base to any substance, and may be said to be rather lively, often continuing for some time constantly opening and closing.

It also throws out lobes in the manner of other *Actiniadæ*, and these at times completely cover the disk. If touched it instantly contracts, but does not turn sulky, commencing immediately to re-open, which it does very slowly, and this by exserting the tentacles on one quarter of the disk before it begins to exsert those on the other three quarters. The tentacles have not the motion of *Actinia* or *Anthea*. I dropped a piece of meat on the disk when opened, it remained there some little time without being taken into the stomach; after some time the animal wished to rid itself of the meat, it then slowly bent over, and the meat rolled or floated across the tentacles without being impeded by them. When taken this animal was perfectly smooth and free from all foreign substances, such as sand and gravel.

The appearance of this *Corynactis* reminds me of a coronet, the heads of the outer row of tentacles bearing a resemblance to the balls on the edge of the coronet, and this more so than in either *C. viridis* or *C. Allmanni*; and I should have proposed the specific name of *coronalis*, did it not partly apply to the other species.

Corynactis heterocera, it will have been seen by the description, differs very materially from the other British species, in the form of the tentacles, the colour, the superior size, the coriaceous texture, its general immutability of form, and in having no foreign substance attached to the epidermis when caught, as in *C. Allmanni*. I have named it *heterocera* in reference to its most prominent distinction from the other species in its differently shaped tentacles.

Hab. Dredged in Weymouth Bay, in 8 fathoms of water, on a gravelly bottom, Sept. 10, 1853.—*Proc. Zool. Soc.* Nov. 8, 1853.

On the Species confounded under the name of Laminaria digitata, *with some Observations on the genus* Laminaria.

By M. A. Le Jolis.

The author has studied for several years the structure and development of the various forms of the so-called *Laminaria digitata* growing in the neighbourhood of Cherbourg. He states that his observations agree with those of Clouston made at the Orkneys, and considers that, instead of a single species as admitted by most modern algologists, or several as described by some authors, there are in reality two distinct species, commonly known under the name of *Laminaria digitata*.

In the tissues of one of these plants, the symplocenchyma predominates, in the other the merenchyma; the stalk of the former also presents concentric rings and muciferous canals, of which the other is completely destitute. The muciferous canals which are wanting in the stems of many *Laminariæ* exist in their fronds, and the author considers that these organs exist normally in the tribe of *Laminariaceæ*, and are more or less developed in all parts of those plants which are covered with mucilage.

The vegetation of the two species is very different, and the details which have been given as to the singular manner in which *Laminaria digitata* renews its fronds, only applies to one species. In the first species the stem is perennial, and regularly increases in length and thickness every year, forming a new concentric layer at its base, exterior to the old ones, and corresponding with a new whorl of roots which are developed above the others; at the same time a new lamina is formed at the base of the old frond, which being separated from the new frond by a very narrow constriction, at last falls off altogether. These phænomena furnish a means of ascertaining the age of the plant, each concentric layer at the base of the stem, or each row of rootlets, corresponding with the annual production of a new frond. The second species appears to have no such determinate periods of vegetation; the frond grows in a continuous and uniform manner, the stem presents no concentric layers or superposed whorls of rootlets, and no exact indications of age can be derived from the length or the thickness of the stem.

As all observers, with the exception of Clouston, have confounded the two species under the Linnæan name, the author considers that it would only serve to continue the confusion if this name be applied to either of them, he therefore proposes to retain Edmondstone's name, *L. Cloustoni*, for one species, and to give the other the name of *L. flexicaulis*. He gives the following diagnoses of the two species —

1. *Laminaria Cloustoni*. *L.* fibris radicalibus verticillatim radiatimque dispositis, stipite erecto rigido cylindrico rugoso, ad basin valde incrassato, versus apicem sensim attenuato, in laminam multifidam abrupte expanso.

2. *Laminaria flexicaulis*. *L.* fibris radicalibus inæqualiter dispositis, stipite flexili lævi tereti vel subcompresso, interdum basi subconstricto subfusiformi, sursum complanato, in laminam integram vel multifidam sensim abeunte.

In his observations on the genus *Laminaria*, the author remarks that the Algæ forming the genus *Ilea* of Areschoug must be excluded from *Laminaria*, as they differ from it in structure and fructification. *L. brevipes*, Ag. and *L. dermatodea*, Lapyl. also differ in several respects, especially in the form of the root, he places them provisionally in the genus *Haligenia*. The genus *Hafgygia*, formed by Kützing for the *L. digitata*, is inadmissible, as muciferous canals exist in many other Algæ placed by that author in his genus *Laminaria*.

The author proposes the following arrangement of the *Laminariæ*:—

LAMINARIA, Lamx.

Root fibrous and branched. *Stem* cylindrical or subcompressed, solid or fistular. *Frond* flat, ribless, entire or palmate. *Cryptostomata* wanting.

Section I. *Dendroideæ.*

Muciferous canals anastomosing in the cortical layer of the stem, large and scattered in the substance of the frond.

Sp. *L. Cloustoni*, Edin. (Le Jol.), *L pallida*, Grev.

Section II. *Saccharinæ.*

Muciferous canals wanting in the stem, small and numerous under the epidermis of the frond.

Sp. *L. flexicaulis*, Le Jol.; *L. Bongardiana*, *β. bifurcata*, Post. and Rupr.; *L. bifida*, Gmel , *L. Ruprechtiana*, Le Jol., *L Chamissoi*, Bory; *L phyllitis*, Stackh., *L. saccharina*, Linn., *L. latifolia*, Ag., *L. Lamourouxii*, Bory , *L. longicruris*, Lapyl.

Species not seen by the author:—

Of Section I.? *L Bongardiana*, P & R.; *L. himantophylla*, P. & R.

Of Section II.? *L. caperata*, Lapyl., *L tæniata*, P. & R., *L. crassifolia*, P. & R

HALIGENIA, Decaisne.

Section I. *Phyllaria.*

H. dermatodea, *H. triplicata*, *H. brevipes.*

Section II. *Saccorhiza.*

H. bulbosa, Decaisne.

Comptes Rendus, Feb. 26, 1855, p. 470.

Descriptions of two new Species of Humming Birds, from Peru.

By JOHN GOULD, F.R.S.

1. SPATHURA CISSIURA.

General plumage bronzy green; wings purplish brown; four outer tail-feathers purplish steel-black; under surface green, paler on the throat, thighs thickly plumed and of a reddish buff.

Total length, 4¼ inches; bill, ⅝; wing, 1⅝; tail, 2⅜.

Hab. Peru.

Remark.—Most nearly allied to *Spathura Peruana*, but differing from that and all the other members of the genus, in having the outer tail-feathers webbed throughout their entire length, and consequently the spathulate tips less conspicuous.

2. Calothorax micrurus, Gould.

All the upper surface mealy bronzy green; throat of a glittering amethystine hue; under surface buff, deepest on the sides, tail narrow, rigid and black.

Total length, $2\frac{3}{8}$ inches; bill, $1\frac{9}{16}$; wing, $1\frac{5}{16}$, tail, $\frac{3}{8}$.

Hab. Peru.

Remark.—This is a very diminutive species, and differs from all others in the extreme shortness of the tail, which is exceeded in length by both the upper and under coverts.—*Proc. Zool. Soc.* Nov. 22, 1853.

METEOROLOGICAL OBSERVATIONS FOR FEB. 1855.

Chiswick.—February 1. Clear; overcast. 2. Drifting snow. 3. Hazy. 4. Dense fog; foggy throughout. 5. Overcast; drizzly. 6. Snow-flakes; slight rain. 7. Cloudy; clear and frosty. 8. Snowing; drifting snow; boisterous at night. 9. Overcast; sharp frost. 10. Clear and frosty; severe frost at night. 11. Thermometer within 1 degree of zero; clear. 12. Overcast; clear and cold; partially overcast. 13. Snowing; cloudy; clear; intense frost; thermometer at zero. 14. Clear and cold. 15. Snow-flakes; bright sun; frosty haze. 16. Snow-showers; overcast. 17. Snowing, with cold wind; clear; severe frost. 18. Frosty; hazy; severe frost at night. 19. Uniform haze; clear and frosty. 20. Clear and frosty. 21. Overcast. 22. Hazy. 23. Overcast; snowing. 24. Fine. 25. Overcast. 26. Rain. 27. Foggy; rain. 28. Drizzly; large halo round the moon in the evening.

Mean temperature of the month	28°·01
Mean temperature of Feb. 1854	37 ·67
Mean temperature of Feb. for the last twenty-nine years	39 ·07
Average amount of rain in Feb.	1·54 inch.

Boston.—Feb. 1. Cloudy. 2. Fine. 3. Cloudy; rain and hail P.M. 4. Foggy; rain P.M. 5. Foggy; rain A.M. 6, 7. Cloudy; snow P.M. 8. Cloudy; stormy P.M. 9—11. Cloudy. 12—14. Fine. 15. Fine; snow A.M. 16. Fine; thermometer early A.M. 6°·5. 17—22. Fine. 23. Cloudy. 24. Fine: snow A.M. 25. Cloudy. 26. Cloudy; rain P.M. 27. Cloudy; snow A.M. 28. Cloudy.

Sandwick Manse, Orkney.—Feb. 1. Damp A.M.; sleet-showers P.M. 2. Thaw, bright A.M.; clear, frost P.M. 3. Thaw, showers A.M.; damp P.M. 4. Thaw, damp A.M.; showers P.M. 5. Showers A.M. and P.M. 6. Sleet-showers A.M.; clear P.M. 7. Clear, frost A.M.; snow-showers P.M. 8. Bright, frost A.M.; cloudy, frost P.M. 9. Clear, frost A.M.; cloudy, frost P.M. 10. Cloudy A.M. and P.M. 11. Snow-showers A.M. and P.M. 12. Snow-showers A.M.; snowing, aurora P.M. 13. Snow-drift A.M.; clear P.M. 14. Snow, bright A.M.; clear, aurora P.M. 15. Snow, bright A.M.; cloudy P.M. 16. Snow, bright A.M.; clear P.M. 17. Snow, thaw A.M.; cloudy P.M. 18. Snow, clear A.M.; clear P.M. 19. Snow, clear A.M.; cloudy P.M. 20, 21. Snow, clear A.M.; clear, aurora P.M. 22. Snow, clear A.M.; lunar halo P.M. 23. Snow, cloudy A.M.; snow drift P.M. 24. Snow drift A.M. and P.M. 25. Snow, cloudy A.M.; snow, clear P.M. 26. Snow-showers A.M.; snow, clear P.M. 27. Snow, bright A.M.; snow clouds P.M. 28. Thaw A.M.; rain P.M.

Mean temperature of Feb. for twenty-eight previous years	38°·24
Mean temperature of this month	31 ·64
Mean temperature of Feb. 1854	39 ·22
Average quantity of rain in Feb. for fourteen previous years	3·39 inches.

The mean temperature of this month is lower than that of any month for the last twenty-eight years—the whole period of observation—except February 1838, when it was 31°·31, and when there was snow during all the month and for three weeks previously. This month it lay from the 11th till the last day, and the drift on the 23rd and 24th formed high wreaths in many places, rendering the roads impassable to vehicles.

Meteorological Observations made by Mr. Thompson *at the Garden of the Horticultural Society at* Chiswick, *near London; by* Mr. Veall, *at* Boston; *and by the* Rev. C. Clouston, *at Sandwick Manse,* Orkney

Days of Month.	Barometer					Thermometer.					Wind			Rain		
	Chiswick.		Boston 8¾ a.m.	Orkney, Sandwick.		Chiswick		Boston, 8¾ a.m.	Orkney, Sandwick		Chiswick 1 p.m.	Boston.	Orkney, Sandwick.	Chiswick	Boston.	Orkney, Sandwick.
1855 Feb	Max	Min.		9¼ a.m	8¾ p m	Max	Min.		9¼ a.m.	8¾ p.m						
1.	30·002	29·786	29·60	30·06	30·22	33	17	30	35	35½	ne.	ene.	w.	...	...	·08
○ 2.	29·990	29·752	29·85	30·22	30·21	32	27	27	37½	30	e	ene	e	·32	...	·08
3.	29·510	29·429	29·38	30·00	29·73	39	23	34	35	35	e	ene.	e.	·05	...	·10
4.	29·384	29·229	29·13	29·53	29·60	39	33	32·5	36½	36	e	ne	e.	·02	·10	·03
5.	29·308	29·287	29·03	29·70	29·76	40	31	35·5	36	35½	sw.	n.	nne	·01	·73	·04
6.	29·542	29·318	29·20	29·86	29·98	35	29	33	36½	26	ne.	n	nne	·02	·31	·03
7.	29·811	29·744	29·55	30·09	30·20	36	27	33	35	33	ne	nne.	nne	...	·15	·04
8.	29·792	29·662	29·64	30·24	30·24	32	27	31	33½	32½	e.	e	sse.	...	·11	·03
9.	29·883	29·871	29·68	30·34	30·24	30	15	28·5	31½	32	ne.	e.		...	...	...
☾ 10.	29·867	29·635	29·64	30·00	29·89	30	1	27	37½	35	ne.	ene	ne	...	...	·01
11.	29·534	29·472	29·35	29·81	29·83	35	20	24	34½	30	ne.	nne	nne.	...	...	...
12.	29·481	29·465	29·30	29·75	29·70	36	23	28	33	29	ne	ene	ne.		...	·12
13.	29·443	29·356	29·22	29·58	29·58	29	0	28	29	23	ne.	calm		...	...	·15
14.	29·400	29·322	29·10	29·57	29·69	36	17	21·5	26	23	n.	n.	e		...	...
15.	29·925	29·699	29·49	29·80	29·87	34	10	22	35	20	n	calm	sw.		...	...
● 16.	29·954	29·811	29·72	29·88	29·83	32	19	29	31	28	ne.	se.	ssw	...	·09	·11
17.	29·897	29·869	29·70	29·70	29·74	27	2	24	35	34½	ne.	ne.	wnw	...	...	·06
18.	30·010	29·980	29·80	29·91	29·95	29	3	12	34½	32	ne.	w	nw.	...	...	·01
19.	29·966	29·883	29·77	29·97	30·01	33	20	24	31½	29	e.	e	...	...	...	·07
20.	29·732	29·691	29·58	29·96	29·91	35	8	23·5	28	24½	e.	ne.	.	...	...	...
21.	29·855	29·837	29·60	29·94	30·00	30	10	24	31	27	ne	nne.	ssw	...	...	...
22.	29·934	29·877	29·72	29·98	29·93	34	23	11	30	20	e	nnw.	e	...	...	·03
☽ 23.	29·986	29·853	29·65	29·66	29·70	37	18	28	29½	30	ne.	s.	w	...	...	·02
24.	30·007	29·391	29·70	29·46	29·37	44	33	26	28	32	sw	ssw.	wnw	·60	·12	...
25.	29·354	29·314	29·05	29·37	29·46	49	37	37	33	27½	sw.	n	n.	·10	...	...
26	29·532	29·469	29·25	29·48	29·66	40	32	35	30	32½	nw	ne	wnw.	·04	·15	...
27.	29·811	29·602	29·50	29·69	29·56	42	37	33	27	35½	s	s.	se.	·06	·13	...
28.	29·777	29·737	29·43	29·41	29·17	50	29	36	38½	36	sw.	s	sse.	·13	·29	·31
Mean.	29·738	29·619	29·48	29·820	29·823	35·64	20·39	27·7	32·44	30·85				1·35	2·18	1·32

THE ANNALS

AND

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[SECOND SERIES.]

No. 89. MAY 1855.

XXVIII.—*On the Structure of Chlorophyll.*

By Hugo von Mohl*.

I consider that it will not be a work of supererogation to bring forward some observations on the anatomical conditions of chlorophyll, since the description I gave of this structure,—playing so important a part in physiological phænomena,—in a dissertation which appeared in 1837 (Vermischte Schriften, p. 349), has been on various hands declared erroneous, while, after repeated investigations, I am compelled to the opinion that these supposed refutations are based upon a false conception of the actual conditions. In the essay referred to I endeavoured to establish the view, that the chlorophyll-globules consist of a soft substance, related to albumen, in which, in most cases, one or more starch-grains are imbedded, and which owes its green colour to the presence of an extremely small quantity of colouring matter; but the view which I attacked, previously advocated chiefly by Meyen, that the chlorophyll-granules are utricles, has again found supporters.

Among these Nageli is especially to be cited, since he not only most decidedly asserted the utricular nature of the chlorophyll-granules, but also endeavoured to establish the anatomical definition of the utricle in a conclusive manner, and to demonstrate a thorough analogy between this and the cell; which would have gone to show the existence of a special class of elementary organs. (Zeitschrift für wiss. Botanik, Heft iii. and iv. 1846, p. 94. Translated in Ray Society's volume for 1849, p. 161.)

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* Translated from the 'Botanische Zeitung,' February 9th & 16th, 1855, by Prof. Henfrey.

To come to a clear understanding, therefore, it will be first of all necessary to consider the notion of the *utricle*, as laid down by Nageli; and this is the more requisite, since his definition of it deviates most essentially in several particulars from the usual signification of the word in common language. According to Nägeli's definition, it is on the one hand unnecessary that an organic utricle should be hollow, while on the other, a hollow space occurring in the cell-contents, even when surrounded by a membrane, is not in all cases to be called a utricle, but it is an essential part of the notion of the latter, that, like the cell, it possesses a proper membrane and contents which exhibit peculiar changes. According to this definition, a vacuole in the protoplasm, filled with water, even if the mucilaginous fluid bounding the cavity is condensed through the influence of the water, and forms as it were a membrane, is by no means to be called a utricle, and still less may we apply this name to a globular mass of proteinous substance, the outermost layer of which is hardened into a membrane-like coat, when such a body occurs in the cell-cavity. The decision of the question, whether a structure occurring in the vegetable cell is a utricle, depends rather, according to Nageli's view, on the investigation whether this consists, like cells, of a membrane and contents of different nature from the membrane, and whether it exhibits altogether, in reference to membrane and contents, metamorphoses analogous to those with which we are acquainted in cells.

Nageli believes that he has found these properties, characterizing the utricles, displayed most convincingly in nuclei, starch-granules, chlorophyll-granules, and other granulose structures occurring in cells. He states that these possess, like cells, a colourless membrane composed of cellulose, which originates subsequently to the contents, increases in thickness, like the cell-wall, by lamellar deposits in the interior, divides by the formation of daughter-utricles, &c.; in short, he holds the structure of the utricle to correspond completely to the organization of the cell, and the only distinction he finds between utricle and cell is, that the former contains no cytoblasts, and, as a structure enclosed in the cell, is not an immediate, but merely a mediate or indirect elementary organ of the plant.

As in my researches on chlorophyll-granules, just as in nuclei, starch-granules, &c., I could find neither a membrane distinct from the contents, nor, still far less, a cellulose coat comparable to the cell-membrane, I expressed myself, in my "Elements of the Anatomy and Physiology of the Cell," against this utricular theory, as a representation standing in most decided contradiction to the facts; that this was done in few words will be understood from the circumstance, that in the said work I was compelled to compress a summary of a large proportion of the physiology of plants into a few sheets.

A very important part of this doctrine of the organization of the utricle, proposed by Nageli, has been retracted by himself recently, since he acknowledges (Systemat. Uebersicht der Erscheinungen im Pflanzen-reiche, 1853, p. 15) that he was wrong in ascribing to the utricle a membrane composed of cellulose. With this, however, he did not give up the opinion that the chlorophyll-granules are utricles and structures analogous to cells, but, on the contrary, finds it inconceivable that in the year 1850 I had not yet detected the membrane of the cell-nuclei and chlorophyll-granules,—since this, if we might be in doubt as to its presence in fresh granules, presents itself so distinctly when these structures swell up in water.

In this later treatise Nägeli explains the origin of the membrane in a manner which stands in most glaring contradiction to his earlier views on the nature of an independent membrane and on the necessary properties of the utricle He takes his stand namely upon the phænomenon, that the surface of the proteinous structures occurring in the cell-sap exhibit a membranaceous consolidation through the action of the cell-sap where they are in contact with it, as for example the vacuoles full of cell-sap, the protoplasm-currents, &c. According to his view, the primordial utricle originates, in free cell-formation, through this action of the cell-sap, by condensation of the superficial layer of a semi-fluid proteine-compound; and in like manner hardens the surface of minute portions of proteine-compounds, which are to be converted into nuclei, chlorophyll-granules, &c. These latter structures correspond completely therefore, excepting in the want of the cellulose-coat, to cells, only they are arrested at a lower stage of development.

In this theory we have two points to take into consideration . 1. the question whether the outer, firmer surface of a soft substance, which forms the boundary of the medium with which it is in contact, is to be regarded as a membrane, and whether the soft substance becomes a utricle through the formation of this firmer limiting portion; and 2. whether this firmer layer of a nucleus, of a chlorophyll-granule, or the like, is comparable with the primordial utricle.

The first question must be answered most decidedly in the negative; indeed Nägeli himself spoke most definitively against this, so long as he believed in the presence of a cellulose membrane clothing the granule. If indeed it were really a fact, that, as Nägeli now (System. Uebersicht, p. 16) states, the microscope demonstrates on many mucilaginous filaments or masses, and around the cavity of vacuoles in the mucilage, a *dense, membranaceous coat*,—this would certainly be an evidence in favour of a membrane having been formed around soft or fluid contents, for a substance which forms a coat over another must be of different nature from the latter—must be distinguishable from it. But the microscope shows no trace of this distinction; it shows nothing more than that the structures in question are sharply defined against the cell-sap at their surface. Whether the surface of the protoplasm and of the granulose structures proceeding from it, are firmer than their internal substance, can never be directly made out by the microscope, just as little as we can see in a drop of water, whether the view of those physicists is correct, who believe that the outer surface of every fluid has a firmer consistence than its internal portions. That in regard to the protoplasm this definite limitation on the outside has very frequently been wrongly taken as evidence of the existence of a membrane, is well known; I need only refer, in respect to this, to the opinion of Schultz, who looked upon the protoplasm-currents as currents of milk-sap flowing in the ramifications of a vascular system. We see nothing more on the firmer structures of the cell-contents composed of proteine-substances than we do on these currents, which indicate so clearly, by their movement and their continual changes, that their surface is not formed by a membrane; for all exhibit merely a simple outline. At the same time it is not denied, and I have never denied this (see my observations on the nucleus in the "Vegetable Cell"), that the surface of these structures, for instance of the nucleus, may and frequently does possess a firmer consistence than the internal portion. But this is not enough to constitute a membrane, for it is indispensable to the notion of the latter, that it forms a layer definitely bounded on *both* surfaces, either, as in the superimposed layers of cell-membrane, agreeing in structure with the adjacent tissue and only mechanically separate from it, or consisting of a special, different tissue; but it by no means suffices for the formation of a membrane, that a homogeneous substance possesses a sharply defined surface of firmer consistence, if this firmer layer passes insensibly into the rest of the substance, so that no one can determine where the outer layer ceases and the internal substance begins. In such a case, looking at the outer surface, we may say it is membranaceously consolidated; but we only open the door to confusion, if we use for the naming of this condition the same expression as that which we apply to a peculiar or special layer forming a definite contrast to the subjacent substance: in ordinary life such a confusion may be passed over, but in scientific works, treating of anatomical conditions, such diverse conditions must not be confounded together*. No less totally unfit is it, if we would adhere to the universally established notion of the utricle, to apply the name *utricle* to a more or less soft, yet not fluid, globular mass, the surface of which is of firmer consistence, for the notion of a utricle is essentially that of a cavity surrounded by a solid substance either filled with a liquid or gaseous fluid or quite empty. But it is common to all the structures described by Nägeli as utricles, that they have neither an envelope distinguishable from the contents, nor a cavity, while the vacuoles, which he does not call utricles, actually possess both. Thus, no expression can be more misapplied, for the denomination of the former structures, than that of a utricle. With as much right could we give the name *bladder* to a cheese which has a rind resulting from the drying of its surface, for in its essential relations it does not much disagree, although on a larger scale, with Nägeli's utricles consisting of proteine-substance.

It is by no means to be denied, that a globular mass of organic substance may acquire a membranous coat through a hardening of its outer layers, and become converted into a utricle, in the manner stated by Nägeli. But for the application of this expression to be fitting and admissible, it is requisite that the said process should actually have taken place, that a separation of envelope and contents should have occurred. In his recent treatise Nägeli leaves it wholly in obscurity, whether he now, as formerly, regards the granular structures of the vegetable cell as surrounded by a coat with a double outline, or not,—probably the former, since he does not acknowledge as erroneous the circumstance, that a membrane exists, but only the point, that he had incorrectly believed this to consist of cellulose, and objects it to me, as something inconceivable, that I have not yet detected this membrane. This however will at all events never make any one believe, who has seen a chlorophyll-granule or a starch-granule through a good microscope, that the figures in plate 3 of his 'Zeitschrift' are correct, in which he (especially in figs. 10, 12, 14, 15 & 17; Ray Society's volume for 1849, pl. II. figs. 10, 12, &c.) represents these granules clothed with a colourless coat completely distinct from the contents and exhibiting a double outline; such an appearance is never found anywhere in nature.

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* It is an evident imperfection of our anatomical terminology, that we possess no expression to indicate such a condensed surface in contradistinction to a real membrane. The naturalists who describe the Infusoria have the same difficulty; thus Dujardin, for example, says, on a similar occasion, "I willingly admit that this surface may, by contact with the surrounding liquid, acquire a certain degree of consistence, like flour-paste or glue allowed to cool in the air, but simply in this manner, and without the production of a layer differently organized from the interior." I propose to apply to such a consolidated surface the term *pellicula*.

The alteration of the chlorophyll-granules in water, in which their membrane is said to present itself so distinctly, will be spoken of more particularly further on, when it will be shown that phænomena occur here, deviating essentially from the descriptions of former observers.

With regard to the second point of Nägeli's theory, the agreement of the hardened surface of the granules with the primordial utricle of the cell, this comparison is devoid of any solid foundation. The cases in which the primordial utricle can be observed in the fresh cell, without application of alcohol, acids, iodine, &c., and without its appearance being obscured by the rest of the contents of the cell, are anything but frequent. In such cases, for instance in *Zygnema* and *Cladophora*, it presents itself as a special layer composed of a finely granular substance, not coalescing with the remaining contents of the cell, defined equally against the cavity of the cell and on the outside, with which layer the structures composed of proteine-compounds, the circulation currents, and the layer containing the chlorophyll, are indeed in contact, but from which they are sharply separated. In an anatomical point of view, in the occurrence as an independent layer, therefore, there is an essential distinction between the primordial utricle and the outer consolidated surface of the chlorophyll-granules, &c. That we cannot everywhere observe the primordial utricle as an independent layer is correct, but it would be a mistaken course to set out from indistinct observations and build a theory upon these. Unless we would open the door to unbridled fancy, we must take our stand upon cases in which the conditions can be observed in the simplest details, and these speak for the separation of the primordial utricle, as an independent layer, from the remainder of the cell-contents.

Farther, no parallel can be drawn, in a physiological point of view, between the primordial utricle and the more solid outer layer of the nucleus, chlorophyll-granules, &c. On the outside of the primordial utricle, and, we have ground to assume, in consequence of its action, cellulose membranes are formed; on the outside of the chlorophyll-granules, &c., this never takes place. From this difference of function we must deduce a difference of the organs. As relates to the chemical character of the primordial utricle, we still know very little about this. That it is coloured yellow by iodine, and hardened by the action of alcohol and acids, is by no means any proof that it is nothing but a layer of proteine-substance; its elements may have an essentially different chemical composition. In reference to this we should note particularly that Mulder, who certainly has claim to give an opinion here, could demonstrate proteine in it in many cases, but not in all, and states that he does not know the compound of which it is composed (Physiological Chemistry, Edinburgh, Translation, p. 409). With this slight knowledge possessed of the chemical characters of the primordial utricle, Nageli's theory that it owes its origin to a coagulation of a proteine-substance, caused by the cell-sap, is unfurnished with any safe foundation.

With Nageli must be named particularly, among the champions of the utricular nature of the chlorophyll-granules, Goppert and Cohn, who in their essay on *Nitella* (Botanische Zeitung, 1849, p. 681), published in the interval between the two works of Nageli above mentioned, gave a minute account of the chlorophyll-granules of this genus. They came to the conclusion, that although the chlorophyll-granule in general did not allow of the demonstration of any definite structure during life, yet the alterations which it underwent in water prove that it is composed of a clear, colourless membrane which becomes distended in water, of green fluid contents, and several solid nuclei composed of starch.

Passing to the exposition of results of my own investigations, it will be most to the purpose to examine first the character of the chlorophyll of *Zygnema*, since the great mass in which the chlorophyll occurs here, in the form of the well-known spiral bands, greatly facilitates the investigation, if we select for examination the larger species, such as *Z. nitidum*. I have shown in my former essay, that these green bands agree, in the most essential conditions of their structure, with chlorophyll-granules, since, like the latter, they are composed of a soft substance, coloured brown by iodine, which owes its green colour to an extremely small quantity of colouring matter, so that the share which the latter takes in the formation of the entire mass cannot be determined. The roundish granules which occur at intervals in the median line of the chlorophyll-bands, and assume a blue colour with iodine, are not, as appears at first sight, single grains of starch, but are composed of globular heaps of some six starch-granules crowded together. These are therefore comparable to the compound starch-granules which occur abundantly in the chlorophyll-granules of the interior of leaves and inner layers of bark, unless it be preferred, for which however there does not seem to me to be any reason, to regard them as chlorophyll-granules, imbedded in a green mucilaginous layer here divided into spiral bands.

The chlorophyll-bands undergo most remarkable alterations when we cut across the cell in which they lie under water, and thus allow water to enter into the cavity. The bands with which the water comes in contact swell up and push out in an irregular manner, in particular portions of variable length, globular or ovate, or if they are long, spirally curled masses. Originally these protrusions are uniformly green, but subsequently, one or more colourless vesicles, composed of a homogeneous mucilaginous substance and filled with water, break out from them. These vesicles do not originate by the up-lifting, from the green substance, of a membrane lying on the surface of the band, of which indeed no trace can be detected; on the contrary, it does not admit of doubt that these vesicles break out from the interior of the band, and tear and push aside the green substance, which only expands to a certain extent. Comparison of a great number of these vesicles also leaves no doubt that their number and form, and the place where they originate, is unconnected with the internal organization of the band, but purely accidental. The vesicles break out sometimes in the middle, sometimes in the edge of the band, sometimes push the green substance to one side, sometimes tear it across and push it away to the two ends, where they meet the prolongations of the band; sometimes only a short piece of the band is transformed into a vesicle, sometimes a long piece, in which lie one to five of the above-mentioned starch-granules. The latter in the meantime undergo no further alteration than that the individual granules of which they are composed become more evident, as is always the case when water acts upon chlorophyll which contains starch-granules; they do not swell up, and are stripped off the vesicles with the green substance. Iodine colours the entire substance of the bands brown, the green mass darker, the vesicles lighter.

There cannot be the slightest doubt that the cause of the phænomena just described lies in an endosmose set up by the internal substance of the chlorophyll-band. At the same time we must note well, that these phænomena are of essentially different kind from those which Goppert and Cohn state that they observed in the action of water upon chlorophyll-granules. It is evident, namely, that the endosmose is not brought about here by fluid contents mixing with the water that has penetrated, separated from the water by a membrane, but by a tough substance, not dissolving in water, which has the property of forming vacuoles when it absorbs water, receiving the water into these vacuoles and thereby producing an endosmose independently, without the cooperation of a separate membrane. The water which penetrates, therefore, does not serve, as represented by Göppert and Cohn, to increase the mass of a green-coloured fluid, and to expand a colourless membrane enclosing this, but the previously homogeneous internal substance of the chlorophyll-band is converted into a sort of frothy mass, like what may be so often observed in the protoplasm of cell-contents. The circumstance that the vesicles formed in this way are colourless or only weakly tinged (for this cannot be accurately made out), and break out from the interior of the chlorophyll-band, through its outer green layer, indicates that the substance of the band is not homogeneous, but that its internal substance especially attracts water, is softer, and more capable of extension than the external substance. These occurrences further tend to show that the green colouring matter is principally, if not exclusively, deposited in the outer layer; but this does not seem to me to be altogether certainly proved, since we cannot decidedly state what are the respective shares which the considerable mechanical expansion, and the original want of colour, bear in producing the colourless or lightly tinted condition of the vesicularly expanded internal substance; on this point the examination of a transverse section of a band could alone furnish a decided answer, but I know of no means by which this could be obtained and observed in an unaltered condition. This much however is certain, that the green colour, if it does not uniformly permeate the whole substance, is still not restricted to a definitely bounded outer layer, since we should see this bounded, at the edge of the band, by a defined line.

[To be continued.]

XXIX.—*Notice on the question of the presence of an Operculum in the genus* Diplommatina, *Benson, and description of a new Species.* By W. H. Benson, Esq.

A further reference to Capt. Hutton on the subject of the operculum of *Diplommatina*, since the publication of Dr. J. E. Gray's stricture in the July Number of the 'Annals' for 1853, just before my departure from England, having elicited no reply from my correspondent, I proceeded on the 17th instant to a further examination by the gradual destruction of the lower whorls of several specimens of *D. folliculus* and *costulata*; which operation resulted in the detection of the operculum in both species, in which it was found to be withdrawn to a distance of from 1½ to 2 whorls and upwards from the aperture, so as to render its detection without that process impossible. Encouraged by this success, I have, since then, broken up a couple of specimens of *D. Huttoni*, Pfr., a reversed species, from Jerripani below Mussoorie, and one of my two specimens of a new sinistrorse Australian species, and have been equally successful with both, the opercula being similarly remote, and retained fully two whorls from the opening of the shells. I lose as little time as possible in acknowledging the correctness of Dr. Gray's reference of the genus to the *Cyclostomacea*, and in making known the discovery that my former opinion on the subject is untenable

The expectation of finding the operculum at or near the aperture, induced by Dr. Gray's statement in a note dated in February 1853, that the operculum was "the usual external one, the size of the mouth of the shell," had caused me to stop short of the sacrifice of specimens in which no trace of the operculum could be perceived from the aperture; but the statement in his published note regarding its extreme minuteness created a suspicion that it might be found in a remote part of the shell, and this expectation was so fully borne out by experiment, that the unusual retraction of the accessory valve must be regarded as a generic character in *Diplommatina*; and if Dr. Gray's examples occurred within view from the aperture of unbroken specimens, we are authorized to conclude that the animals must have been suddenly killed, and prevented from retiring to their usual recondite position. The smallness of the operculum also explains why the tooth on the internal part of the columella affords no obstacle to the passage of the valve to the remoter whorls, and why no modification of its circular form is necessary for the execution of that movement, in spite of the apparent obstruction presented.

Dr. Gray correctly reminds us that "the operculum of *Acme fusca* was overlooked by many malacologists, and has been denied after it was described by others, as is the case with that of *Diplommatina*;" for, in the list of those who contested its existence in *Acme*, we find the honoured name of De Férussac, and at as late a date as that of the publication of Gray's edition of 'Turton's Manual *,' the now patent fact was opposed, and the shell was classed, like *Diplommatina*, with *Carychium*, instead of with its real ally, *Cyclostoma elegans*; so that the supporters of the Carychiadous affinity of *Diplommatina* have erred in good company—

"——veniam damus petimusque vicissim."

The fact seems to be, that in these minute shells the exceeding delicacy of the transparent operculum causes its concealment, during life, by the mucus of the animal, and it is not until this has dried up, and become more or less separated from the hard covering, that the latter becomes visible: in *A. fusca* it remains in the mouth of the shell, but being so much smaller than the aperture in *Diplommatina*, it is drawn to a greater distance than in any other known operculated land mollusk. This habit also accounts for the absence of loose opercula in the boxes in which specimens have been kept, as observed by Capt. Hutton and myself; the valve is drawn tightly into the narrower whorls, and there remains a fixture, as long as the lower whorls are preserved entire.

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* Edition of 1840.

It is worthy of note that, in September 1849, Professor Albert Mousson of Zurich wrote as follows, when acknowledging specimens which I had sent to him:—"En examinant bien attentivement l'ouverture de votre *Diplommatina folliculus*, garnie d'un bord entier, et la costulation extérieure, on est frappé de la ressemblance avec le genre *Pomatias*, Stud. Veuillez bien en parcourir un plus grand nombre et vous assurer s'il ne s'en trouve pas quelques individus munis encore de leur opercule en parchemin." His prognostication has proved tolerably correct.

It is desirable that some collector possessing the doubtful Philippine shell, *Cyclostoma minus*, Sow. (*D. Sowerbyi*, Pfr.), should devote a specimen to a search for the operculum, which, if the species really belongs to *Diplommatina*, will doubtless be found in its ordinary retracted position, when its structure will decide the question.

Diplommatina Australiæ, nobis.

Testa sinistrorsa, rimata, subovato-conica, glabra, subremote-costata, pallide cornea, spira ovato-conica, apice acutiusculo, anfractibus sex convexis, ultimo angustiore, antice ascendente, apertura verticali, subcirculari, peristomate duplice, posteriori expanso, anteriori expansiusculo, marginibus nitidis, diaphanis, callo junctis, exteriori superne breviter producto, columellari dilatato, tuberculo inconspicuo vel obsoleto. Operculo remoto, normali, lamella vix elevata.

Long. 3½, diam. vix 2 mill.

Hab. ad Mount Warren, Point Danger, Australiæ Orientalis. Teste Strange.

About the same size as *D. folliculus*, Pfr., it is less acuminate, and may at once be known by its sinistrorse volutions, more distant costulation, and by the produced portion of the outer lip near its junction with the body whorl. The operculum occurs at the distance of two whorls from the aperture. Mr. Strange told me that he had found it under dead leaves in the brushes. The occurrence of the genus at such a distant point, in a southern latitude, from its Himalayan head-quarters, is an interesting fact. Perhaps diligent search on decayed leaves, in damp situations, may reveal other species in the intervening lands.

Nice Maritime, 22nd March 1855.

XXX.—*Short Characters of some new Genera and Species of Algæ discovered on the coast of the Colony of Victoria, Australia.* By W. H. Harvey, M.D., M.R.I.A. &c., Keeper of the Herbarium of the University of Dublin.

[With a Plate.]

1. Bellotia, Harv.

Frons filiformis, solida, umbellatim ramosa; apicibus ramorum fasciculato-comosis. *Receptaculum* in quoque ramo unicum, cylindricum, mediam partem rami circumvestiens, e paranematibus simplicibus, verticalibus, dense stipatis constitutum. *Sporæ* ad paranemata lateraliter dispositæ, oblongæ, transversim striatæ.

Bellotia Eriophorum, Harv.

Hab. Cast ashore at the Heads of Pt. Phillip Harbour, and also on Phillip Island, Western Port. Perennial?

Root clothed with stuppose filaments. *Stems* many from the same base, 1 to 2 feet long, twice as thick as hog's bristle, terete, rigid, somewhat horny, twice or thrice umbellately divided. *Umbels* of twenty to thirty rays or more, from 3 to 4 or 5 inches apart; the bases of all the rays tomentose, the rest bare and quite smooth. *Apices* of all the branches crowned with a very dense spherical tuft of brown filaments, $\frac{1}{2}$ to $\frac{3}{4}$ inch in diameter. *Receptacle* cylindrical, developed round each branch, and formed of very densely packed, simple filaments (*paranemata*), vertically issuing from all sides of the branch, and whorled round it. This receptacle begins to be formed in the upper half of all the young branches, above the middle, and extends at first nearly to the commencement of the apical tuft; but as the growth continues the barren portion of the branch above the receptacle considerably elongates, and the receptacle, in a full-grown branch, is removed to about the middle portion, where it forms a sausage-shaped swelling nearly 2 inches in length and thrice the diameter of the barren branches. The *paranemata* are quite simple, articulated, cylindrical, their cells three or four times as long as broad, filled with pale olive endochrome. *Spores* linear-oblong, sessile on the sides of the paranemata, alternate or secund. *Substance* of the stem and branches rigid; of the apical tufts soft, and when young somewhat gelatinous. *Structure*: a cross cutting of the stem shows a firm cellular substance composed of minute polygonal cells, set in lines radiating from a central point.

This very remarkable plant forms quite a new type in ramification in the family of the *Sporochnoideæ*, to which it belongs. Except in the colour, which is olivaceous brown, one of its umbellate branches bears a very striking resemblance to the manyheaded cotton-grass (*Eriophorum polycephalum*); whence the trivial name. The genus itself is inscribed to the memory of the late lamented Lieut. Bellot of the French Navy, who so nobly volunteered his services for the search after Sir John Franklin, and whose untimely death will not soon be forgotten.

2. CURDIEA, Harv.

(but not of Harv. MS. in Herb. T. C. D. 1852).

Frons plana, coriaceo-membranacea, laciniata, e margine sæpe pinnatim foliolosa, duplici strato constituta; cellulis interioribus rotundato-angulatis majoribus peripheriam versus sensim minoribus, periphericis minimis verticaliter subseriatis. *Coccidia* marginalia, globosa, sessilia, sporas minutas in filis ex placenta carnosa centrali radiantibus evolutas, intra pericarpium crassissimum cellulosum carpostomio apertum foventia. *Tetrasporæ* in *nematheciis* intramarginalibus oblongis evolutæ, cruciatim divisæ.—*Algæ* rubro-sanguineæ, siccitate rigidæ.

Curdiea laciniata, Harv.

Hab. Cast ashore at Port Fairy, Port Phillip Heads, and Western Port. Not uncommon.

Frond 1 to 2 feet long, very variable in ramification; the lacinia from ½ inch to an inch broad, cuneate at base, linear-oblong, variously cleft, the lesser segments narrow, obtuse. Sometimes the margin is winged with leaflets. *Substance* when dry rigid, seldom adhering to paper. *Coccidia* marginal, gland-like, generally very numerous on fertile plants. *Nemathecia* oblong or linear, within the margin, elevated, composed of vertical, articulated filaments, among which the tetraspores are found.

In habit this plant resembles a large coarse-growing specimen of *Callophyllis laciniata*, but the structure and fruit are very different. *Curdiea* belongs to *Sphærococcoideæ*, and stands next to the section *Podeum* of *Gracilaria*, from which and from every other allied genus the position of the tetraspores separates it. The name is bestowed in honour of Dr. Daniel Curdie of Tandarook, near Geelong, an early observer of the Algæ of Australia, and to whom I am indebted for an interesting collection of Algæ collected at the mouth of the Glenelg River, near Cape Northumberland. I originally selected a genus of *Chætangieæ* to bear Dr. Curdie's name, and have distributed specimens to some friends under the name *C. australis*, Harv. MSS., but since my visit to Australia I have ascertained that the plant so named is identical with *Acrotylus australis*, J. Ag., with whose *cystocarp* Prof. Agardh was unacquainted when he classed it among *Cry-*

ptonemeæ. I have now collected numerous fruiting specimens, and find that the structure of the *cystocarp* is identical with that of *Chætangium,* near which genus *Acrotylus* must now be placed. It is in fact very closely related to the section *Nothogenia.*

3. GULSONIA, Harv.

Frons gelatinoso-membranacea, teres, nodoso-annulata, decomposite ramosa, ex tubo centrali crasso articulato monosiphonio filis anastomosantibus longitudinalibus laxe circumdato, et filis horizontalibus excurrentibus dichotomis fastigiatis muco hyalino firmiori inclusis constituta. *Fructus* . . . . .

Gulsonia annulata, Harv.

Cast ashore, Phillip Island, Western Port. Rare.

Fronds densely tufted, 6 to 8 inches long, decompoundly much branched, the branches and their divisions and ramuli irregularly scattered, all tapering to the base and apex, and all annularly constricted at short intervals; the nodes swollen and deeply coloured, the internodes pale, like very narrow transverse rings. A cross section shows a very large central tube, surrounded by a narrow stratum of longitudinal filaments, from which radiate towards the circumference, dichotomous, callithamnoid, fastigiate filaments, whose branches are separated by pellucid jelly of firm consistence, a layer of which also forms a pellucid envelope of the branch. A longitudinal section shows that the central tube is septate, the septa at intervals of 6 or 8 diameters apart; and that the longitudinal filaments anastomose into a laxly netted filamentous sheath, enclosing the central tube. The filaments of the periphery are thrown off irregularly from the outer part of this sheath. *Colour* a fine pinky-red, staining the paper on which the plant may be dried. *Substance* very soft.

This beautiful plant, of which the fruit is at present unknown to me, seems to be the type of a new genus of *Cryptonemiaceæ,* which I inscribe in honour of Mrs. Gulson of Exmouth, whose explorations of the shells and Algæ of the Devonshire coast are well known to and appreciated by British naturalists. From its structure I am disposed to place *Gulsonia* near *Catenella* or *Gattya,* from both which it differs sufficiently in habit, substance and structure to forbid its union under either. It may also be compared to *Gloiopeltis* and *Endocladia,* but differs essentially from these in several particulars. In external habit it may be compared to a gigantic *Crouania,* or to a *Lomentaria* or a *Champia* with very short joints and of a very soft substance. In size, colour and substance it something resembles *Champia affinis* when fresh, but more rapidly decomposes.

4. Hanovia, Sond.

Hanovia australis, Sond.—The *cystocarps* of this plant have been sent to me by my friend Geo. Clifton, Esq., of Fremantle, West Australia. They are *ceramidia*, closely resembling those of a *Dasya*. Hence this genus must be removed from *Ceramiaceæ* to *Rhodomelaceæ*, where it will be placed next to *Halydictyon*.

5. Ballia, Harv.

1. *Ballia Robertiana*, n. sp.; ramis minoribus, rachidibusque plumularum cylindraceis (nec ad genicula constrictis) distiche plumulatis, plumulis incurvis oblongis bipinnatis oppositis inter se alterne inæqualibus, una pusilla pinnata v. vage multifida ramulis inflexis, altera elongata bipinnata basi ramulis incurvis vage divisis fructiferis stipata, pinnis ambitu ovatis, pinnulis oppositis incurvis creberrimis obtusis. (Pl. VIII. C. fig. 2.)

Hab. Port Fairy.

2. *Ballia Mariana*, n. sp; ramis minoribus rachidibusque plumularum cylindraceis (nec ad genicula constrictis) tristiche plumulatis v. verticillatis, plumulis incurvis e quoque geniculo ternis vel pluribus inter se inæqualibus, duobus pusillis inferne multifidis superne pinnatis rachide longe excurrente, uno majori verticillatim plumellato, plumellis patentibus pinnatis bipinnatisve rachide excurrente, ramulis ultimis oppositis vel sæpe alternis. (Pl. VIII. C. fig. 1.)

Hab. Port Fairy.

6. Apjohnia, Harv.

Frons stipitata, dendroides. *Stipes* radicatus, monosiphonius, clavatus, annulatim constrictus et transversim rugulosus, epidermide tenui calcarea donatus, in ætate majori apice ramis coronatus. *Rami* confervoidei, umbellatim polychotomi, flabellatim expansi, fastigiati, liberi, articulati; articulis clavatis monosiphoniis, omnibus basi ruguloso-annulatis, succo aquoso viridissimo repletis.

Apjohnia lætevirens, Harv.

Hab. In deep tide pools, near low water mark, Phillip Island, Western Port.

Fronds rising from a mat of very tough and rigid branching fibres, densely tufted, 3 to 6 inches high, stipitate, tree-like. *Stipes* from an inch to an inch and a half long, clavate, nearly 2 lines in diameter at the thickened upper extremity, at first obtuse and quite simple, consisting of a large, single cell filled with watery endochrome. In advancing age this primordial cell throws out from its apex four or more similar but smaller cells, each of which is afterwards crowned with four or five more, and thus, by repeated developments, an umbellately flabelliform, fastigiate frond is formed. The space between each axil (or each *internode*) invariably consists of a single cell, enlarging upwards, and annulated in its lower half. The older branches are thinly coated with calcareous matter; the younger are membranaceous.

This plant is named in honour of Dr. James Apjohn, Professor of Chemistry in the University of Dublin, and Mrs. Apjohn, the latter of whom is a zealous collector and observer of British Algæ, the former, I need not say, is worthy of any scientific commemoration that may be offered to him. The genus belongs to *Valoniceæ*, and among Australian genera will stand nearest to *Struvea*, Sond.; but is much more closely related to the West Indian *Chamædoris*, Mont., from which, however, it differs sufficiently in habit and character. In aspect *Apjohnia* looks almost like a very luxuriant and robust specimen of *Cladophora pellucida*, though not very closely related to that plant.

Melbourne, January 10, 1855

XXXI.—*Some Remarks on Vegetable Placentation.*
By John Cleland, Esq.*

The object of the few following remarks is to bring forward some evidence against the axile theory of placentation, and to show that the free central placenta found in many plants is really composed of a second whorl of carpels with everted edges.

My observations are founded entirely on the *Lychnis* and *Primula*. In the latter we have the most perfect example of a free placenta, while the former illustrates most distinctly the theory which I wish to bring forward.

On opening the fruit of the *Lychnis dioica*, its carpels are seen to be united into a perfect circle, and to present no trace of their homology with the leaf except in the venation on their internal surface. When the seeds are removed the funicular cords are seen arranged in five vertical double rows with smooth spaces between. On making a transverse section, these smooth spaces are found to be composed of a pad of white cellular tissue, and alternating with them and with the rows of cords are the five rays of a star-shaped mass of the same white cellular substance occupying the centre. This star seems clearly to indicate the formation of the placenta from five parts, and the position of the cords in five series shows the same thing. But this is not consistent with the axile theory. If ovules are ever equivalent to buds emanating directly from the axis, they must in every such case be more or less under the law of evolution followed by the leaves, and however their arrangement may seem from circumstances to depart from that law, they cannot observe a system of distribution essentially different. We find a whorled arrangement followed by every other homologue of the leaf, and should expect it here too. But in the case before us, the ovules are given off in vertical double rows. The objection may be started, that this appearance may result from the piling of whorls one on another without alternation, just as the stamen is in front of the petal in the Barberry and the Buckthorn, or rows of petals are piled in front of one another in abnormal specimens of the Camellia But if this explanation be adopted, we have still to account for the rows being double, and for each row being connected by vascular tissue with the one on the other side of the adjoining interspace, while to its fellow it is only joined by interstitial cellular tissue.

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* Read before the Botanical Society of Edinburgh, April 12, 1855.

On the other hand, if we adopt the ordinary marginal theory, we have staring us in the face the old objection, that there is no trace of any connexion ever existing between the placenta and wall of the ovary; but on the contrary, between the double rows of cords where the carpels are supposed to have turned inwards, we have a smooth pad of cellular substance. Moreover we should expect the rays of the central star to be pointed to the interspaces instead of being in the position we find them in; for by this theory each pair of rows is formed from the margins of one carpel and has nothing to do with the neighbouring pairs, and we should therefore expect to find *a* (fig. 1) connected by vascular tissue, not with *b*, but with *c*.

What I wish to suggest as a better explanation than either of the above is, that this placenta is formed of a second whorl of carpels, distinct from and alternating with the outer carpels, and bearing the ovules on their everted margins. This view accounts for the arrangement of the vascular tissue. The double rows of cords are considered according to it as formed from the margins of two adjoining carpels, and the true fellow of each of the component rows is the one at the other side of the neighbouring interspace, and the bundles of fibres represent the midribs of the leaves. This view was first suggested and seems to be very considerably supported by the monstrosity which I have figured, in which two members of the inner whorl had assumed the foliaceous form (fig. 2). One of them was much contorted on account of its excessive development in a confined space, but the other retained its place in the whorl with its edges everted.

The structures of the Primroses seem also to support the notion of a second carpellary whorl. In their case the common marginal explanation appears to particular disadvantage, and I hope to show that in respect to them too the free central explanation is untenable. The ovules indeed are sessile, and so closely set on the placenta, that it is impossible to say from their position what is their arrangement—whether whorled round an axis or in vertical rows. But other evidence is not wanting.

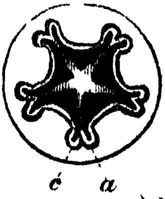

Fig. 1

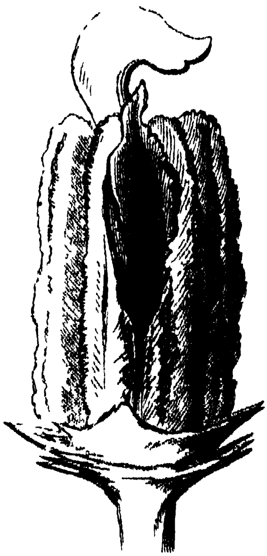

Fig. 2

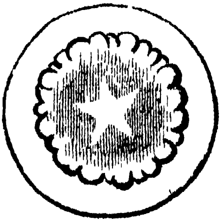

Fig 3

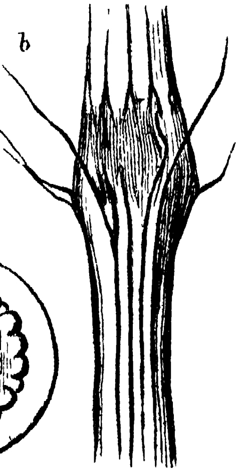

Fig. 4.

First, in a well-developed fruit of the Auricula, I have observed a five-rayed star of cellular tissue in the centre (fig. 3).

Secondly, at an early period the placenta of the Primrose is formed of two parts, one in the centre vascular and united to the torus, the other superficial, distinct, and easily removed, cellular and bearing the ovules. If the ovules were buds, the cellular tissue of their first origin could not have this superficial disposition, but would be the ascending axis of the plant, whose true position is central.

Thirdly, if the central part were a continuation of the axis, we should find some at least of the fibrous bundles from the stem running directly into it, but instead of that, the fibres are entirely re-arranged at the base of the ovary; a joint is formed at this point by decreased size of the cells of the cellular tissue, and the first appearances of fibres in the placenta are not prolonged upward from the stem, but descend to meet those of the stem (fig. 4).

These facts seem conclusive against the axile theory in the case of the Primroses; and if in them it does not hold, we have a strong argument against its truth in any case. It seems improbable at the outset that the ovule should vary so much in morphological value as to be in one plant equivalent to a bud, and in another perhaps not far removed from it, only a secondary growth from a single leaf. This of itself prejudices one against believing that we have placentation of both the marginal and axile kind; and another circumstance likewise irrespective of arguments drawn from the structure of the pistil in particular species is in favour of the marginal theory, viz. that the pollen-grain, which is the male equivalent of the ovule, is always a mere offshoot from a leaf homologue, and we might not unnaturally expect the ovule to have the same morphological value.

XXXII.—*On the Attitudes and Figures of the Morse*[*].

By Dr. J. E. GRAY, Ph.D., F.R.S., V.P.Z.S.

THE arrival of a living Morse, or Walrus, in this country, showing that it is very different in its manner of moving from the Seals, has induced me to examine and compare the figures which have hitherto been given of this animal. Most of the oldest figures were purely imaginary. To this series must be referred the *Rosmarus* and

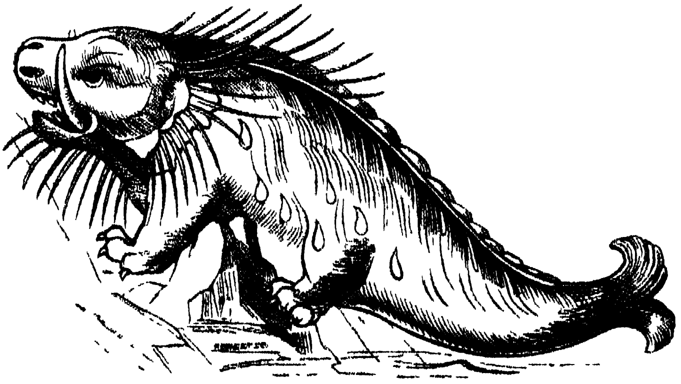

Fig. 1. *Rosmarus.* Gesner, Addenda, 368, 16. 1560.
(Reduced one-ninth.)

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[*] From the Proceedings of the Zoological Society, No. 254, p. 112.

Vacca marina in the Addenda to Gesner (pp. 368, 369), published

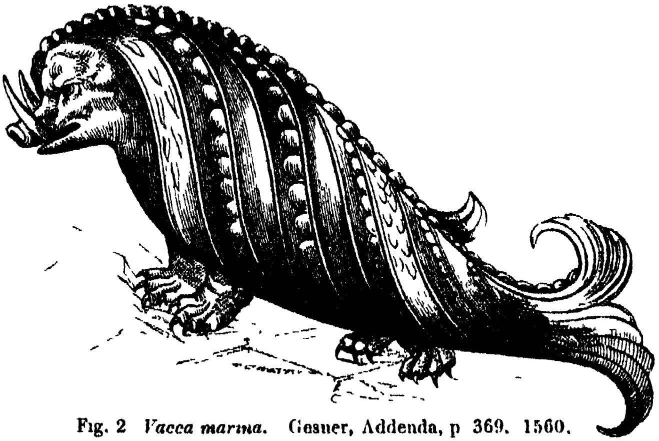

Fig. 2 *Vacca marina.* Gesner, Addenda, p 369. 1560.
(Reduced nearly one-third.)

in 1560, and the *Porcus monstrosus* of Olaus Magnus (p. 788), published in 1568. They all have more or less elongated tails, four feet, and the elongated tusks in the lower jaw.

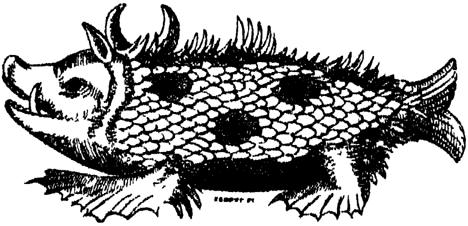

Fig. 3. *Porcus monstrosus Oceani Germanici.* Olaus Magnus, 1568, p. 788.

The *Rosmarus* of Olaus Magnus (p. 789) agrees with the preceding in most of its characters, but has the tusks in the upper jaw.

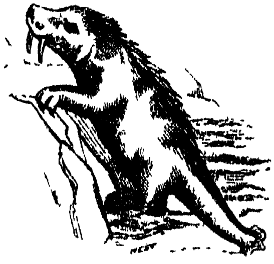

Fig. 4. *Rosmarus seu Morsus Norvegicus.* Olaus Magnus, 1568, p. 789.

Gesner, in his Icones, 1560 (p. 178), gives another figure more like a Seal, and with the teeth in the upper jaw; but it is represented as having four feet, with claws like a Cat's, the fore legs being furnished with short wings at their junction with the body, and the body ends in a broad fan-like tail, similar to the hinder extremities of the Seal This figure is copied in Jonston's 'Pisces,' t. 14, in 1657.

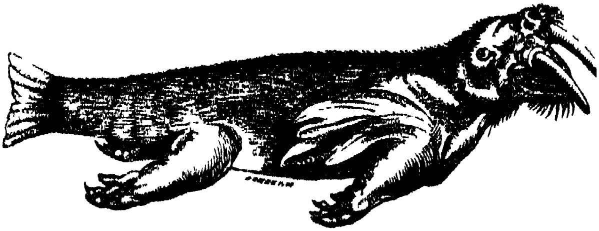

Fig 5 *Rosmarus* Gesner, Icones Animalium, 1560, p 178. De Cetis, Ord. xii

(Reduced two-thirds)

Fig 6. *Sea Horse.* 1609

In 'The Three Voyages to the North in the year 1609,' reprinted by the Hakluyt Society, a plate shows a "true portraiture of our boat, and how we nearly got into trouble with the sea horses." This animal is represented like a Seal, with the teeth in its upper jaw, but the back is arched, and the belly a considerable distance from the ice, on which it is walking. Another very rough seal-like figure is given in Marten's 'Spitzbergen in 1675,' tab. P. fig. *b*. Buffon,

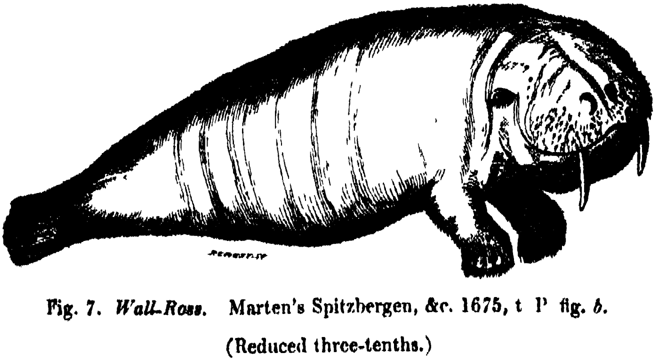

Fig. 7. *Wall-Ross.* Marten's Spitzbergen, &c. 1675, t P fig. *b*.

(Reduced three-tenths.)

in 1765, in the tenth volume of his 'Histoire Naturelle,' t. 54, gives the figure of a male, evidently from a stuffed skin, exactly resembling the common Seal in form and position, and this figure has been repeatedly copied.

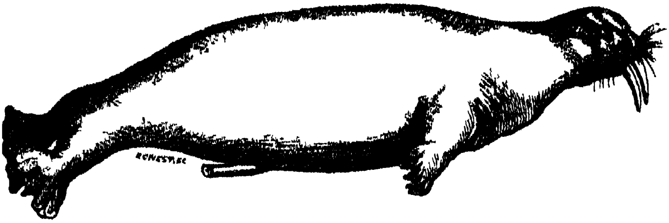

Fig 8 *Le Morse.* Buffon, xiii. t 51 ♂ 1765.

(Reduced two-fifths)

In a small quarto tract, called the 'Histoire du Pays nommé Spitsberghe, écrit par H. G. A., Amsterdam, chez Hessel Gerrard A.,' 1613, a plate at page 20 contains an excellent figure of the Morse and its young, "ad vivum delineatum ab Hesselo G. A."

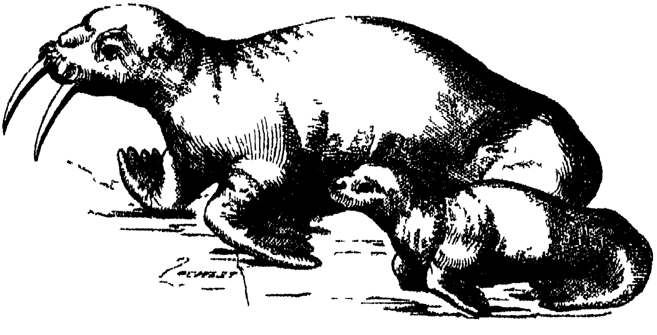

Fig. 9. ***Walruss.*** **Ad vivum delineatum ab Hesselo G. A.**

Histoire de Spitsberghe, by H. G. A , 1613. Another edition, same date

(Reduced four-sevenths.)

This figure was repeated in Laet's 'Amer. Descript.' p. 28, 1633, by Jonston, 'Pisces,' t. 44, in 1657, and by Shaw, 'Zoology,' t. 68*, from Jonston.

In Cook's last 'Voyage' there is a fine plate (t. 52), after a drawing by Westall, of a boat's party attacking a drove of Sea-horses; the centre animal of this group is copied, under the name of the Arctic Walrus, by Shaw, 'Zoology,' t. 68. This figure also represents the animal in its natural position, with the hinder legs bent under the body, but the figure is more artistic and less natural than that of Mr. Hessel Gerrard A.

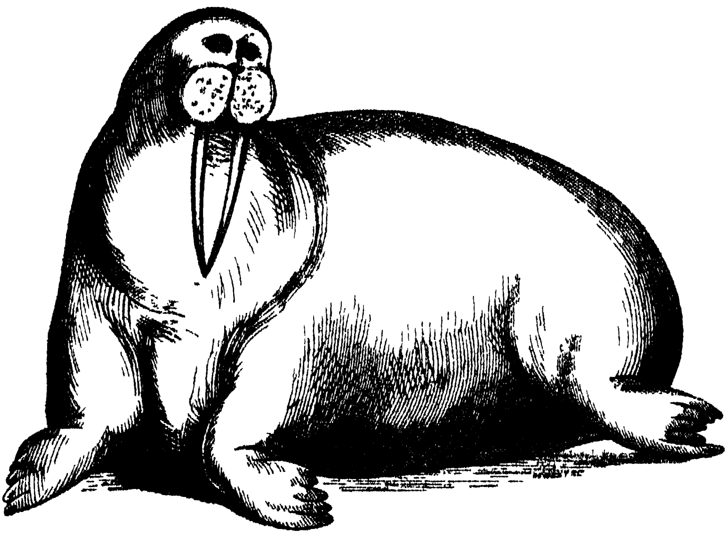

Fig 10 *Arctic Walrus* Cook's last Voy t 52 Shaw, Zool t 68
(Reduced one-sixth)

XXXIII.—*Descriptions of Eight New Species of Birds from South America.* By John Gould, Esq., F.R.S.

Before describing the following birds, all of which are in my own collection, I would remark, that I have submitted them to the inspection of Mr. P. L. Sclater, who has paid much attention to South American birds, and who pronounces them new to science; I therefore embrace the earliest opportunity of placing them upon record.

Campylorhynchus hypostictus, Gould.

General hue of the upper surface brown, the feathers edged with greyish-brown, producing a somewhat spotted appearance; from above each eye, down the side of the neck, an obscure streak of buffy-white; upper tail-coverts dark brown, fringed with reddish-brown; along the margins of the primaries a series of dark brown dots on a light brown ground, tail brown, with lighter edges dotted with dark brown like the primaries; under surface greyish-white, with a streak of light brown down the centre of each feather, small on the throat, gradually increasing on the abdomen, and assuming the form of bars on the flanks; under tail-coverts buff, barred with dark brown; irides red, bill light horn-colour; feet olive-brown.

Total length, 8¼ inches; bill, 1; wing, 3½; tail, 3⅞; tarsi, 1.

Hab. Ucayli in Peru.

Remark.—This species is very closely allied to *C. scolopaceus*, Spix, but differs in being of a rather larger size, in having a somewhat more curved bill, a more uniformly coloured back, and in the greater number and larger size of the brown markings of the under surface, which, moreover, extend on to the upper part of the neck and throat.

CHAMÆZA NOBILIS, Gould.

Head very dark brown suffused with rufous, upper surface, wings and tail-coverts rich reddish or saffron-brown; tail reddish-brown, crossed by a broad black band near the end, and tipped with slightly buffy-white on the centre feathers, and much more conspicuously on the lateral ones, lores fawn-colour; under surface white, the feathers of the breast broadly, and those of the centre of the abdomen narrowly bordered on the sides with brownish-black; on the flanks the latter hue increases to such an extent as to leave only a lanceolate stripe of the white down the centre of each feather, under tail-coverts buff, speckled with brown; above each eye a narrow streak of buff commencing a little in advance of the centre of the eye, and extending downwards as low as the nape; irides brown, bill black, feet reddish-brown.

Total length, 9½ inches, bill, 1⅛; wing, 4½; tail, 2⅞, tarsi, 1¾.

Hab. Chamicurros, on the eastern side of Peru.

Remark.—This is the largest and perhaps the finest species of the genus: its legs and feet are very powerful, its bill thick and strong, its tail very short and rounded, its wings concave, and its plumage offers that silkiness to the touch which is so characteristic of the members of the genus *Chamæza*, of which it forms in every sense a typical example.

FORMICARIUS NIGRIFRONS, Gould.

Band across the forehead black; crown, occiput and nape deep chestnut; upper surface and wings rich brown; central primaries edged at the base with yellowish-brown; base of the inner web of the primaries and secondaries golden, showing conspicuously on the under surface, but not perceptible on the upper, the outer covert at the shoulder with a streak of ochreous-yellow along the margin of its outer web; tail brown at the base, gradually deepening into black at the tip; throat, neck and breast sooty-black, abdomen and under tail-coverts fuliginous-brown, assuming an olive tint on the flanks; irides brown; bill black; feet dark brown.

Total length, 7 inches, bill, ⅞; wing, 3⅜, tail, 2¼; tarsi, 1⅛.

Hab. Chamicurros, on the eastern side of Peru.

Remark.—About the same size and nearly allied to *F. Cayennensis*, but may be at once distinguished from that species by the bar of black on the forehead.

FORMICARIUS ERYTHROPTERUS, Gould.

Head, upper and under surface and the tail black; feathers of the shoulders and mantle fringed with grey, giving it a scale-like appearance, those of the back fringed in a similar manner, but so narrowly as to be scarcely apparent; tail-coverts black, edged with rusty-red; extreme edge of the shoulder white, wing-coverts black, tipped with dark rust-red, forming first a narrow bar of red, and then a broad one of black, primaries rusty-red, largely tipped with black; secondaries rusty-red at the base, then black and tipped with rusty-red, the extent of the red increasing as the feathers approach the body, orbits naked and apparently red; bill black; feet fleshy-brown.

Total length, 6¾ inches, bill, ⅞; wing, 3½; tail, 2½; tarsi, ¾.

Hab. Interior of Demerara.

Remark.—This is a very fine species. The specimen above described, which is the only one I have seen, is in my own collection.

SCHISTOCHLAMYS SPECULIGERA, Gould.

Head, neck, breast, back, wings and tail black; base of the third, fourth and succeeding primaries white, forming a small conspicuous patch in the centre of the wing; lower part of the back, rump and upper tail-coverts grey; under surface of the wing, abdomen and under tail-coverts white; flanks grey, with a few black feathers interspersed on the sides of the chest, irides red, bill, legs and feet greenish.

Total length, 6¾ inches; bill, ¾; wing, 3; tail, 3; tarsi, ⅞.

Hab. Ucayli in Peru.

THAMNOPHILUS CORVINUS, Gould.

The entire plumage deep black with the exception of the shoulders, on which is a broad mark of white; bill black; feet dark olive.

Total length, 7 inches; bill, 1⅛; wing, 3⅜; tail, 2⅝, tarsi, 1¼.

Hab. Ucayli in Peru.

THAMNOPHILUS MELANURUS, Gould.

Male.—Crown and sides of the head, crest, back, lesser wing-coverts and tail, black; the wing-coverts tipped with white; remainder of the wing blackish-brown; throat and all the under surface white; bill black, becoming lighter at the base; feet olive-brown.

Total length, 8½ inches, bill, 1¼, wing, 3½; tail, 3½; tarsi, 1¼.

Female.—Crown of the head, crest, upper surface of the body, wings and tail, chestnut; throat and chest white, passing into the mingled grey and sandy-red of the flanks; feathers clothing the thighs rusty-red tipped with white; bill blackish-brown; feet olive-brown.

Hab. Ucayli in Peru, I have also received examples from Bogota. I must remark, however, that the specimens from the latter locality are somewhat smaller than those from Peru.

THAMNOPHILUS HYPERYTHRUS, Gould.

Crown and sides of the head, all the upper surface and tail, slaty-black; wings brownish-black, with a spot of white at the tip of each of the coverts, forming three semicircular rows across the wing, chin, breast and abdomen rich dark chestnut-red, gradually blending on the flanks and vent into the dark hue of the upper surface, bill black, feet olive-brown.

Total length, 7 inches; bill, 1; wing, $3\frac{1}{8}$; tail, $2\frac{1}{2}$; tarsi, 1.

Hab. Chamicurros in Peru.

Remark.—I believe the above to be the description of a female.

XXXIV.—*On the Impregnation and Germination of the Algæ.* By Dr. PRINGSHEIM.

To the Editors of the Annals of Natural History

GENTLEMEN, April 25, 1855.

THE author having forwarded me a copy of the *resumé* of his researches lately laid before the Berlin Academy, with a request that I will make them known in England, I have drawn up a brief abstract of them, and beg to offer this for insertion in your pages.

I am, Gentlemen, yours very truly,
ARTHUR HENFREY.

VAUCHERIA.

Besides the large ciliated zoospore, so fully described by Unger and others, the *Vaucheriæ* possess organs, known by the names of *capsules* or *sporanges* and *horns*. These were regarded by Vaucher as sexual organs, and he believed that the horns performed the functions of anthers, stating that they emitted a dust-like product, which he compared to the pollen of Phanerogamia, and imagined to exert a fertilizing influence upon the contents of the sporanges. This view has been contested by subsequent authors, some of whom have stated that a *conjugation* takes place, between the horn and the sporange, analogous to that seen in *Zygnema*, &c. Karsten (Botan. Zeitung, 1852, p. 89) has given an elaborate description of such a process. Dr. Pringsheim believes that Vaucher approached nearest to the truth, and states that the supposed conjugation is altogether imaginary. According to his recent researches, the horn is really an *antheridium*, since its contents become converted into spermatozoids, bodies which when in motion appeared stick-shaped, but when allowed to come gradually to rest, presented the appearance of minute clear vesicles, 1–180 of a line in diameter, and furnished with two unequal cilia. Contemporaneously with the development of the spermatozoids in the horns, the contents of the capsules, or spore-fruits, become accumulated towards the beak-like summit, which opens at the same time that the spermatozoids are set free by the bursting of the membrane at the apex of the horn. Vast numbers of these little bodies make their escape, some already free, others engaged in mucus. The free ones spread in all directions with a rapid movement; great numbers, twenty, thirty or more, make their way into the opening of the spore-fruit, coming into contact with the tough mucilaginous layer bounding the contents. After a time a distinct membrane appears all over the mass of contents of the spore-fruit, converting them into a free cell, the spore, and the author states that he several times saw a largeish colourless corpuscle *inside* the mucilaginous coat of the contents; he believes this to have been a spermatozoid which had penetrated into the mass. The process as here described is therefore the impregnation of a mass of contents by a spermatozoid, and *a subsequent formation of the cell-membrane of the spore.* An important incidental point here is the confirmation of the view recently set forth by the author, that the primordial utricle of Mohl, the protoplasmic layer forming the external boundary of the mass of contents, does not exercise a secreting function, producing the cellular membrane on its surface, but becomes actually *transformed into the latter**.

The new spore does not at once fall from the parent plant; its green contents grow paler and at last become colourless, with the exception of one or more largeish dark brown bodies. When it has totally lost its colour, it falls away through the decomposition of the membrane of the spore-fruit. Some months later the spore again resumes its green colour, germinates and grows out into a filament resembling the parent.

FUCUS VESICULOSUS.

The author next gives an account of his observations on the impregnation of *Fucus*, which agree with those lately published by Thuret in the 'Annales des Sciences Naturelles.' The process closely resembles that just described in *Vaucheria* in its essentials, since it consists of the advent of a quantity of spermatozoids to a spore, at that moment consisting of a protoplasmic mass clothed only by its primordial utricle, the penetration of the spermatozoids into the mass, and the *subsequent* formation of the cellulose coat of the spore.

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* This view is elaborately worked out in his recent work, 'Untersuchungen über den Bau und die Bildung der Pflanzenzelle, part 1. Berlin, 1854.

[These observations render necessary a careful re-examination of the impregnation in the higher plants. It is by no means certain that the so-called germinal vesicles in the embryo-sac of the flowering plants possess a cellulose coat before the influence of the pollen-tubes has been exerted. This point was not ascertained in my observations on *Orchis morio*; and I have observed appearances since, in *Santalum album* and other plants, which render it probable that the germinal bodies are only globular masses of protoplasm at the moment of impregnation.—A. H.]

FLORIDEÆ.

The interpretation of the reproductive structures of this class is still very imperfect. From some observations made lately on *Ceramiæ*, Dr. Pringsheim is induced to regard the tetraspores as gemmæ, or gonidia. But the capsule-spores germinate in a totally different way,—not growing at once into plants like the parent, but producing an irregular structure, which the author suggests may be a kind of *prothallium*, analogous to that of the Ferns. However, his experiments on the cultivation of these bodies were unsuccessful.

SPHACELARIA.—CLADOSTEPHUS.

Thuret discovered the existence of antheridia in *Cutleria*, containing spermatozoids, very different from the antheridia of *Fucus*. Pringsheim has detected antheridia in *Sphacelaria tubuloides*, more resembling those of *Fucus*. These antheridia consist of one or more large cells formed in the *sphacelæ* at the ends of the branches. Their contents become converted into a quantity of minute roundish bodies, at first much resembling the mass of spermatozoids in the unopened antheridia of the Mosses. The antheridial cell at length grows out laterally into a tube, which breaks through the wall of the *sphacela*, and opens at the point to discharge the mass of spermatozoids. These are very minute clear vesicles, without a brown spot, and in so far resembling those of the Florideæ; but they possess two cilia, like those of the Fucaceæ, and move actively in the same manner. The author had no female plants at command, and consequently could not observe the further history of the reproduction. Somewhat similar antheridia, opening by a tubular process, were observed last summer in *Cladostephus spongiosus*.

FRESHWATER ALGÆ.

The author next proceeds to consider the general question of the reproduction of those Freshwater Algæ in which zoospores form the commonest means of propagation. From the recognition of the contemporaneous existence of zoospores or gonidia with sexual organs of reproduction in *Vaucheria,* he is led to conjecture the existence of a similar condition in other genera. In *Achlya,* both zoospores and resting spores are known, and he suspects that the slender branches found upon those filaments of *Achlya* which bear sporanges, will prove to be antheridia. In *Œdogonium,* the membrane of the sporangial-cell bursts before the formation of the spore-coat, which admits of the possibility of a penetration of spermatozoids. In *Bulbochæte,* a fissure is also met with. Now in these genera, besides resting-spores and ordinary zoospores, we find exceedingly small bodies, resembling the zoospores in their structure, called by A. Braun *microgonidia.* These are developed in cells smaller, and differing in character from the ordinary vegetative cells. They germinate, but produce small bodies, composed only of one or two cells, which, it is remarkable, are always found attached upon the sporangia, or near them. Here they dehisce and discharge their contents. Although no trace of spermatozoids has been perceived in them, this discharge of the contents near the opening of the sporangial membrane tends to the conjecture that they exercise an impregnating influence on the resting-spore. If this be the case, we should have the curious phænomenon of the male structure being developed as a special separate body, a kind of prothallium. With the above peculiarities is associated in *Bulbochæte* a curious mode of germination of the resting-spores. Examples of these kept through the winter produced, not a new filament, but four ciliated zoospores, which escaped, came to rest, germinated, and then produced new filaments. A similar phænomenon was observed in the case of the resting-spores of *Coleochæte.*

The paper concludes by a summing up of the results, which will be unnecessary after this brief abstract.

BIBLIOGRAPHICAL NOTICES.

A History of the British Marine Testaceous Mollusca, distributed in their Natural Order. By WILLIAM CLARK. London: Van Voorst, 1855.

THE study of malacology, or of the true natural history of the Mollusca, has sprung up almost entirely within the last half-century. Up to this period the attention of zoologists in this department was almost exclusively directed to the shells of these animals, the only part which admits of being easily preserved in the cabinet or transported from a distance, and the structure of the creatures producing them was entirely neglected. This province of zoology was therefore appropriately denominated Conchology.

At the end of the last and the beginning of the present century, however, the first step towards a better state of things was made by Adanson, Poli and Cuvier; the latter, about this period, published anatomical descriptions of twenty or thirty species of Mollusca, belonging to various families, principally of the Gasteropoda. It was soon found that the study of the animals would introduce many new elements into the classification of the Mollusca, and Cuvier, Lamarck and De Blainville each published systematic works, in which the characters of the larger groups were derived as far as possible from the structure of the few molluscous animals with which the authors were then acquainted, whilst those of the minor groups were taken almost entirely from the shells. Of these systems, that of Lamarck was the one most generally adopted, probably from its being accompanied by descriptions of a large number of species, and it is still in use with but little modification by many conchologists, especially in France. For many years, in fact, the Lamarckian system was followed almost exclusively, and the only zoologists who attempted the introduction of any new views into the classification of the Mollusca were Dr. Gray and Mr. Swainson, the former in a slight sketch published in the Synopsis of the British Museum for 1838, 1841 and 1842, the latter in his somewhat imaginative work which forms part of Lardner's 'Cyclopædia.'

But during this period of comparative stagnation in the progress of systematic malacology, numerous naturalists were engaged in collecting observations which were one day to change the whole face of this department of zoology. In our own country, Montagu, Johnston, Alder and Hancock, and the author of the work now under consideration, published descriptions of many of the animals of the British Mollusca; a few continental naturalists performed the same good office for the species inhabiting the seas bordering their countries, and the excellent naturalists attached to the numerous French voyages of discovery contributed a mass of valuable observations upon exotic species, illustrated in most cases with excellent figures.

The numerous and valuable observations contributed by these authors to the natural history of the Mollusca soon introduced a great change into the systematic arrangement of these animals, in which, notwithstanding the efforts of Cuvier and others already referred to, the conchological element still greatly predominated. It was found that shells positively identical in character might serve as the habitation of animals presenting such great differences both in their form and their anatomical construction, that they required to be placed not only in different genera, but even in genera which in a philosophical classification must be separated from each other by a wide interval;—thus, in 1847, Dr. Gray published a list of about thirty genera of Gasteropodous Mollusca, which it is impossible to distinguish from the examination of the shell alone, whilst the animals present well-marked differences, and there is no doubt that subsequent observations will add considerably to this list.

The perception of these facts led zoologists to direct their attention more especially to the structure of the molluscous animal, in forming their classifications, and there can be no doubt that this has been attended with most beneficial results; but many of the partisans of the new system, on their emancipation from the fetters of a pure conchology, rushed into the very opposite extreme, regarding the structure of the hard parts as of no value even in the discrimination of the smaller groups. With the usual zeal of reformers, they required that every trace of their former faith should be destroyed; they tore down the ancient images from the niches in which they had for years commanded respect, but unfortunately in too many cases only to set up new ones in their deserted places.

In this number we must place Mr. Clark, the author of the work whose title stands at the head of this notice. For Mr. Clark the structure of the shell is of little or no value; for although he tells us (p. 239) that he considers "the shell-coverings of the Mollusca as good and useful aids, in strict subservience to the malacology of the animal, and as consequential specialties emanating from the vital organs," he appears generally in the course of his work entirely to disregard the characters derivable from the shell and operculum. It appears to us that Mr. Clark, like many other authors, lays too much stress upon the instances already referred to in which different animals inhabit shells of the same construction. We agree with him in regarding the "shell-coverings of the Mollusca . . . . . as specialties emanating from the vital organs," and therefore think that the characters derived from the structure of the shell and operculum should certainly be regarded as of some value in the arrangement of the Mollusca. Mr. Clark, however, appears to entertain a different opinion, and applies the pruning-knife most unsparingly to all groups which he considers to have a purely conchological origin. As an instance we may refer to his genus *Murex*, in which he includes the whole of the species belonging to the genera *Murex* and *Buccinum* of Linnæus, which are considered by most authors as forming numerous genera, and by many as constituting at least two families.

Mr. Clark's primary principle of classification is derived from the sexual relations of the animals, which he describes as *Hermaphrodita sine congressu*, *Hermaphrodita congressu*, and *Bisexual*, by the latter term we must understand *unisexual*. This principle certainly has not the merit of novelty, which the author appears to claim for it, for his terms as applied to the Gasteropodous Mollusca are exactly identical with the *Paracephalophora hermaphrodita*, *monoica* and *dioica* of De Blainville, and as both the groups of Acephala are defined as *Hermaphrodita sine concubitu*, it is hard to say what is the advantage of this sexual system. Its disadvantages however are more apparent, for when Mr. Clark tells us that the Acephala are hermaphrodite animals, we must regard this statement as a simple assumption in the case of the Palliobranchiata, whilst in regard to the Lamellibranchiata, it is distinctly at variance with generally received views; and we look in vain in our author's pages for a satisfactory reason for adopting his opinion,—his anatomy of *Pholas dac-*

tylus, to which he refers the reader for this purpose, being anything rather than conclusive.

We have already remarked, that the primary groups formed by the author amongst the Gasteropodous Mollusca are identical in their signification with those of De Blainville. This identity also prevails to so great an extent in the contents of these divisions, that we are involuntarily led to believe that Mr. Clark's system is really founded upon that of the French author. Thus, his *Hermaphrodita sine congressu* are the same as the *Hermaphrodita* of De Blainville, with the mere addition of the *Chitonidæ*, a group which De Blainville placed amongst his Malentozoaria with the Cirrhopoda, considering them to form a connecting link with the Articulated type of animals; and this agreement between the two authors is the more remarkable, as it appears exceedingly doubtful whether the phænomenon, from the supposed occurrence of which this group is separated from the other Gasteropoda, ever takes place in this class of animals.

The other two groups, the Monœcious and Diœcious Mollusca, exhibit a similar resemblance to the corresponding divisions in De Blainville's classification, the only difference being that Mr. Clark transfers the *Trochidæ* (with *Valvata*) and *Vermetidæ* (including *Turritella*) to the Hermaphrodite section The grounds urged by Mr. Clark in favour of this change, which is in direct opposition to the views which have prevailed ever since malacology was first studied, are by no means satisfactory, and he himself is forced to admit that they are mere *conjectures*,—an admission which, it appears to us, must greatly detract from any value which might otherwise attach to this system. In both these groups, his opinion that the animals are monœcious, *with congression*, is founded upon the circumstance that he has been unable to discover the male organs, —certainly rather a curious proof of hermaphroditism*. Another result of this adherence to an artificial system is, that the Pulmoniferous Gasteropoda occur in two of the primary divisions,—the *Helicidæ* and their inoperculated allies being placed amongst the *Hermaphrodita congressu*, and the *Cyclostomatidæ* amongst the *bisexual* (unisexual) species, under the denomination of *Gasteropoda Pectinibranchiata*. Under all these circumstances, we have little expectation that the sexual system as put forward by Mr. Clark will ever find much favour in the eyes of malacologists,—and we must regret that an observer of his reputation should have lent the sanction of his name to an arrangement so untenable.

It is not, however, upon its systematic arrangement that the value of the present contribution to malacological knowledge must depend, although the author appears to attach no small importance to it; the work is chiefly interesting from its containing original observations upon the structure and habits of a very great proportion of the Testaceous Mollusca inhabiting the seas which surround these Islands. We may remark in passing, that the work can scarcely be regarded as strictly fulfilling its title. Mr. Clark's observations have been made entirely at one point of our coast, and the work before us certainly proves how much may be done by an energetic observer in a single locality, but we think it would have been as well if a less pretentious title had been chosen;—"Observations on the Mollusca of the South Devonshire Coast," would have exactly expressed the contents of the book.

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* Other authors who have particularly examined the animal of *Valvata*, referred by Mr. Clark to the *Trochidæ*, have proved it to be undoubtedly diœcious; and *Turritella* is in the same case.

But even in its most limited sense, the appearance of this work must be regarded with great interest. For upwards of forty years the author has been engaged in studying the Mollusca; and many of the results of his observations have already been published either in scattered papers by himself, or as contributions to the works of others,—Messrs. Forbes and Hanley especially are largely indebted to him. In fact there can be little doubt that Mr. Clark has examined the animals of more species of the British Mollusca than any other malacologist, and many writers have expressed their regret that he did not bring out his observations in a collected form.

The present work may be regarded as a fulfilment of this wish. It contains, in addition to observations hitherto unpublished on numerous species of British Mollusca, reprints of the author's papers which have appeared in this Journal, and of the notes furnished by him to Professor Forbes for his classic work on the British Mollusca. Subsequent observations have proved many of the author's former statements to be incorrect, but it is much to be regretted that, instead of modifying his descriptions, he has printed them in their original form, followed by observations commencing with "Since the above was written," which not unfrequently contradict the statements made a page or two before. Mr. Clark tells us that he has done this with the express design of showing the process through which he has arrived at his present results, and there can be no doubt that it has the advantage of furnishing us with a test for the amount of reliance that may be placed on the author's observations; but it must be confessed that he would certainly have benefited his reputation as an observer, had he adopted some other course, for the numerous instances in which the author's first (published) impressions have required correction from his subsequent observations, render it by no means easy to place implicit faith in his statements when not confirmed by other observers. As an instance in point, we may refer to the author's descriptions of the branchiæ in *Pandora obtusa*. In a note communicated to the authors of the 'British Mollusca,' Mr. Clark described this animal as possessing "two palpi, one branchial lamina and (perhaps) an obsolete one, on each side the body;" at p. 151 of the present work, he tells us that he "can now say beyond dispute (!), and show the fact by preparations, that there are two palpi and two branchiæ on each side," whilst in the Appendix (p. 513) he returns to his original opinion. It is evident that little dependence can be placed on the observations of an author whose statements upon a simple matter of fact are so variable, and the instance here cited, although perhaps it may be rather an extreme case, is by no means without its parallels in other parts of the book, whilst *single* changes of opinion are not unfrequent, and in these cases we have no means of knowing how soon Mr. Clark might recur to his original view.

We have already mentioned the ruthless manner in which Mr. Clark destroys those genera which he considers to repose on mere conchological grounds, and it was to be expected that the species would share the same fate; but we were hardly prepared for the wholesale destruction of names which have long figured in our lists, that we here meet with. There can be no doubt that science is burdened with an immense number of false species, arising in some cases from a zeal not sufficiently tempered with discretion, in others perhaps from less worthy motives; but we must confess, that when we see the number of species admitted by Forbes and Hanley, which have been suppressed by Mr. Clark, we cannot but suspect that his pruning has been carried on with rather too unsparing a hand.

Mr. Clark appears disposed to attach but little importance to the characters derived from the lingual dentition of the Mollusca, which have been regarded as of great value by Lovèn, Gray, Troschel, and other zoologists. We fear that Mr Clark is as much inclined to undervalue these characters, as some other authors are to over-rate them, for there can be no doubt that the disposition and form of the teeth on the lingual ribbon may afford excellent generic and even family characters, besides serving as important aids in the discrimination of nearly allied species

Notwithstanding the defects pointed out in the foregoing remarks, we must regard Mr. Clark's book as one of the most important original contributions to British Malacology that has been made for some time. It contains a vast mass of valuable observations, including descriptions of the animals of more than 200 of our marine Testaceous Mollusca, with many interesting notices of their habits, and will, we have no doubt, contribute greatly to the advance of this branch of natural history.

The Ferns of Great Britain. Illustrated by JOHN E. SOWERBY. *The Descriptions, Synonyms, &c. by* C. JOHNSON. London, 1855.

We have favourably noticed the first two Numbers of this book, which is now before us in its completed form. The more recently published parts appear to deserve the same meed of praise that we awarded to their predecessors. Indeed we trust that the name of Sowerby will long continue to be in itself a guarantee of the accuracy and beauty of such botanical plates as may bear it. Almost the only fault that we have to find with these drawings of ferns is that in some few cases the top of a frond alone is represented, and thus a satisfactory idea of the plant is not conveyed to the mind. It will perhaps be said that it was impossible in the space afforded by an octavo plate to give more complete representations of the larger plants; but when we see how Dr. Deakin has succeeded in doing so in his 'Ferns of Britain,' that excuse cannot be admitted. It is a singular, and, as it seems to us, unaccountable fact, that writers upon our ferns have by a sort of common consent neglected Dr. Deakin's volume. The only probable cause is, that the large work of which it originally formed a part has but slight value.

Sowerby's figure of *L. Fœnisecii* is not so satisfactory in our opinion as that given by Deakin, although the latter is not so good as could be desired. The cut in Newman's new edition of his 'History of British Ferns' (or rather new work under that name *) is even less characteristic than either of those above mentioned.

We strongly suspect that Mr. Johnson includes some forms of *Cystopteris fragilis* under his *C. dentata*, for we have never seen a specimen of the true plant from Wales, although numbers of fronds so named, but really belonging to *C. fragilis*, have fallen under our notice He has done well in combining *C. Dickieana* with *C. dentata*, and Mr. Sowerby equally well in giving a beautiful figure of that curious variety.

Mr. Johnson appears to have been almost afraid of stating his opinion that *Asplenium germanicum* is more nearly related to *A. septentrionale* than to *A. ruta-muraria*. We have long thought that this is the fact, and even suspected that *A. germanicum* and *A. septentrionale* might prove not to be separable specifically. It does not seem to us to have any very close connexion with *A. ruta-muraria*. The remarks of the Rev. T Bell (quoted in Newm. Ferns, ed. 3. 260, from the Edin. Bot Trans. ii. 119) are well deserving of attention. As observed by Mr. Johnson (p. 57), "it is remarkable that the plant before us should occur both in this country and on the continent in company with *A. septentrionale*, and always very sparingly." This certainly adds to the possibility of their not being really distinct.

It is satisfactory to find that Mr. Johnson has not been led to remove *Pteris aquilina* from its accustomed genus. The name given to his new genus by Mr. Newman is rather unhappily chosen; for the younger Agardh, in his valuable 'Recensio Specierum Generis Pteridis,' places *Pt. aquilina* in the section called by him *Ornithopteris*, not in that named *Eupteris*.

We have much pleasure in recommending Mr. Sowerby's book to the notice of our readers.

First Steps in Economic Botany, for the use of Students. By THOMAS CROXEN ARCHER. London: Reeve, 1854. 12mo.

There are, perhaps, few subjects upon which more ignorance prevails than the origin and nature of the numerous products of the animal and vegetable kingdoms which are in daily use amongst us, and it is a disgrace to a country like this, which professes to be pre-eminently practical, that so little attention should have hitherto been paid to furnishing the rising generation with some sound general information on a subject which should be of so much importance in a commercial community. The knowledge of "common things" does, however, at present appear to be making some little progress amongst us, and the present little work, which contains a brief account of the principal commercial products of the vegetable kingdom, forms a welcome addition to our scanty stock of elementary books on these subjects.

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* We are sorry to see the opinion that we expressed in favour of the second edition quoted as if it was necessarily applicable to the so-called third edition. The great change that has been made in the names, in some cases to the total neglect of the recognized laws of botanical nomenclature, renders this last book far less valuable than its predecessors, and we do not think that some of the other alterations made in it are judicious. The introduction of an erroneous nomenclature into a book written for popular use is especially to be deprecated, as it tends greatly to the establishment, amongst lovers of plants, who are not scientific, of a set of names which botanists must reject.

It appears to have been brought out under the auspices of the "Department of Science and Art," and we presume will be adopted as a class-book in those educational establishments which derive their inspiration from that source. The conception of the work is good, and appears to have been well and carefully carried out. We must observe, however, that the author's acquaintance with chemistry appears to be rather imperfect;—at least on those occasions where he has, unnecessarily as it appears to us, introduced any chemical information, his statements are generally calculated rather to mislead than to instruct the student. Thus, at p. 145, we are informed that the non-oxygenated essential oils "are very inflammable, burning like *coal-gas, of which they appear to be a mere concentration*;" and again, at p. 140, we are told that "oleine and stearine are oxides of a peculiar substance called by chemists *glyceryle*, ... in other words, oleine consists of an acid called *oleic acid* and this sweet substance *glyceryle*, whilst stearine is a compound of *stearic acid* and *glyceryle*,"—from which it would appear that the author has no very definite idea of what is meant by an oxide.

It is greatly to be regretted that such errors as these should have been allowed to creep into a book, which, in other respects, has certainly much to recommend it, and it is not much to the credit of the "Department of Science and Art," whose head certainly has some pretensions to a knowledge of chemistry, that blunders of this nature are to be detected in a work published under their auspices. It is not sufficient that an educational work should be unimpeachable as regards the particular subject of which it treats, care must also be taken that its pages are not made the means of inculcating false notions upon those branches of science which are only incidentally referred to.

We may add that the work is illustrated with twenty lithographic plates, representing some of the more important plants, and a few of the commercial products referred to in the text: these appear to be exceedingly characteristic.

The Entomologist's Annual for 1855. Edited by H. T. Stainton. Second Edition. London, 1855. Van Voorst. 12mo.

It is not long since we noticed, in the pages of this Journal, the appearance of the first edition of this little work, and we must congratulate the editor on his miscalculation of the number of his readers, since they have enabled him so speedily to bring out a new and improved edition.

The observations which we made in our previous notice will apply equally to the present edition, for the greater portion of the work is essentially the same, the additions consisting principally of some excellent directions for collecting and preserving Coleoptera and Lepidoptera by Mr. Wollaston and the Editor, and an address by the latter "to the young entomologists at Eton, Harrow, Winchester, Rugby, and at all other schools." In this Mr. Stainton is at great pains to point out to the young idea that the study of entomology is by no means the contemptible occupation that so many consider it, but that, on the contrary, it is not only pleasing and instructive in itself, but may also be of the greatest service in training the mind to habits of observation, and may even act as an incentive to the acquisition of much useful knowledge which would otherwise be regarded as desperate drudgery. We can agree most cordially with most of Mr. Stainton's propositions, although we fear, with himself, that he has preached "too long a sermon" to his younger readers, and we trust that his enthusiasm may meet its reward in raising up a new generation of entomologists. We are glad to see that a few pages have been devoted to notices of important new works on entomology, and hope that in future years this section of the work will receive more of the editor's attention.

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

March 1, 1855.—Charles Wheatstone, Esq., V.P., in the Chair.

"On the Structure, Functions, and Homology of the Manducatory Organs in the Class Rotifera." By Philip Henry Gosse, A.L.S.

In this paper the author institutes an examination of the manducatory organs in the class Rotifera, in order to show that the various forms which they assume can all be reduced to a common type. He further proposes to inquire what are the real homologues of these organs in the other classes of animals, and what light we can gather, from their structure, on the question of the zoological rank of the Rotifera.

After an investigation of the bibliography of the class from Ehrenberg to the present time, in which the vagueness and inexactitude of our knowledge of these organs is shown, the author takes up, one by one, the various phases which they assume throughout the whole class; commencing with *Brachionus*, in which they appear in the highest state of development. Their form in this genus is therefore taken as the standard of comparison.

The hemispherical bulb, which is so conspicuous in *B. amphiceros*, lying across the breast, and containing organs which work vigorously against each other, has long been recognized as an organ of manducation: it has been called the gizzard; but the author proposes to distinguish it by the term *mastax*. It is a trilobate muscular sac, with walls varying much in thickness, receiving at the anterior extremity the *buccal funnel*, and on the dorsal side giving exit to the *œsophagus*.

Within this sac are placed two geniculate organs (the *mallei*), and a third on which they work (the *incus*). Each *malleus* consists of two parts (the *manubrium* and the *uncus*), united by a hinge-joint. The *manubrium* is a piece of irregular form, consisting of *carinæ* of solid matter, enclosing three areas, which are filled with a more membranous substance. The *uncus* consists of several slender pieces, more or less parallel, arranged like the teeth of a comb, or like the fingers of a hand.

The *incus* consists of two *rami*, which are articulated by a common base to the extremity of a thin rod (the *fulcrum*), in such a way that they can open and close by proper muscles. The fingers of each *uncus* rest upon the corresponding *ramus*, to which they are attached by an elastic ligament. The *mallei* are moved to and fro by distinct muscles, which the author describes in detail, and by the action of these they approach and recede alternately, the rami opening and shutting simultaneously, with a movement derived partly from the action of the *mallei*, and partly from their own proper muscles.

All these organs have great solidity and density; and, from the action of certain menstrua upon them, appear to be of calcareous origin.

The writer proceeds to describe the accessory organs. The ciliated disc has an infundibuliform centre, which commonly merges into a tube before it enters the *mastax*. The particles of food that float in the water, or swimming animalcules, are whirled by the ciliary vortex into this tube; and, being carried into the *mastax*, are lodged upon the *rami*, between the two *unci*. These conjointly work upon the food, which passes on towards the tips of the *rami*, and enter the *œsophagus*, which opens immediately beneath them.

From this normal condition, the author traces the manducatory organs through various modifications, in the genera *Euchlanis*, *Notommata aurita*, *N clavulata*, *Anuræa*, *N. petromyzon*, *N. lacinulata*, *Furcularia*, *N. gibba*, *Synchæta*, *Polyarthra*, *Diglena*, *Eosphora*, *Albertia*, *F. marina*, *Asplanchna*, *Mastigocerca*, *Monocerca*, and *Scaridium*. Some of these display peculiarities and aberrations highly curious. Notwithstanding the anomalies and variations which occur, however, the same type of structure is seen in all; and the modifications in general may be considered as successive degenerations of the *mallei*, and augmentations of the *incus*.

The form of the manducatory organs, which occurs in *Triarthra*, *Pompholyx*, *Pterodina*, *Œcistes*, *Limnias*, *Melicerta*, *Conochilus*, *Megalotrocha*, *Lacinularia*, and *Tubicolaria*, is next examined. The organs are shown to be essentially the same as in the former type, but somewhat disguised by the excessive dilatation of the *mallei*, and by the soldering of the *unci* and the *rami* together, into two masses, each of which approaches in figure to the quadrant of a sphere.

Attention is then directed to what has been called (but by a misapprehension) the "stirrup-shaped" armature of the genera *Rotifer*, *Philodina*, *Actinurus*, &c. Here, however, the organs are proved to have no essential diversity from the common type; their analogy with those last described being abundantly manifest, though they are still further disguised by the obsolescence of the *manubria*.

Floscularia and *Stephanoceros*, the most elegant, but the most aberrant forms of Rotifera, close the series. The *mastax*, in these genera, is wanting; and in the former genus the *incus* and the *manubria* are reduced to extreme evanescence, though the two-fingered *unci* show, in their structure, relative position and action, the true analogy of these organs.

Having thus shown that there is but one model of structure, however modified or disguised, in the manducatory organs of the Rotifera, the author proceeds to the question of their homology. He argues on several grounds that they have no true affinity with the gastric teeth of the Crustacea, though he states his conviction that the Rotifera belong to the great Arthropodous division of animals

It is with the Insecta that the author seeks to ally these minute creatures, and, by a course of argument founded on the peculiarities of structure already detailed, he maintains the following identifications:—that the *mastax* is a true *mouth*; that the *mallei* are *mandibles*; the *manubria* possibly representing the *cheeks*, into which they are articulated; that the *rami* of the *incus* are *maxillæ*; and that the *fulcrum* represents the *cardines* soldered together.

While the author maintains the connexion of Rotifera with Insecta, through these organs in their highest development, he suggests their affinity with Polyzoa, by the same organs at the opposite extremity of the scale, since the oval muscular bulbs in *Bowerbankia*, which approach and recede in their action on food, seem to represent the quadriglobular masses of *Limnias* and *Rotifer*, further degenerated.

If this affinity be correctly indicated, the interesting fact is apparent, that the Polyzoa present the point where the two great parallel divisions, Mollusca and Articulata, unite in their course towards the true Polypi.

March 22.—The Lord Wrottesley, President, in the Chair

"Further observations on the Anatomy of *Macgillivraya*, *Cheletropis*, and allied genera of pelagic Gasteropoda." By John Denis Macdonald, Esq., R N., Assistant-Surgeon H.M.S.V. 'Torch.'

The author states, that in a late voyage from Sydney to Moreton Bay, specimens of *Macgillivraya*, *Cheletropis*, and a few other genera of minute pelagic Gasteropoda, apparently undescribed, were daily taken in the towing-net, and afforded him an opportunity of more precisely determining the mode of attachment of the ciliated arms which he had at first presumed to be naked branchiæ.

In his former paper* it was stated, more particularly of *Cheletropis*

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* Annals, p. 232.

Huxleyi, that the gills were of two kinds, viz. "covered" and "naked;" the former, corresponding to those of the pectinibranchiate Gasteropoda generally, he has never found to be absent in any of the genera; but from further observation of the so-called naked gills, while the animals were alive in their native element, he is disposed to think that they are chiefly employed for prehension, and probably as auxiliary organs of natation When these ciliated appendages are fully extended, the line of cilia is perfectly straight, so that the frilled border, noticed in the previous account, turns out to be a character depending simply on the partial contraction of the longitudinal muscular fibres, preparatory to complete retraction of the organs. They have no connexion with the mantle, but encircle the mouth together with the tentacula and eyes, and coalesce at their bases like the segments of a deeply-cleft calyx. In the specimens of *Macgillivraya* examined the arms were quite transparent, but marked at irregular intervals with cross streaks of brownish purple. In the extended state they were several times the length of the shell, and, like the arms of a polype, they rolled themselves up when touched, and started back into the shell with surprising rapidity. They appeared also to be exquisitely sensitive, exhibiting short twitching movements when minute particles suspended in the water came in contact with them.

In the specimens of *Macgillivraya* now referred to, the respiratory siphon consisted of a process of the mantle converted into a tube by the mere apposition of its borders without organic union, it was moreover much shorter than had been usually observed in previous examples, and the author thinks that those now under consideration may be a variety, if not a distinct species.

In his former examinations of this tribe of Gasteropoda, the author had never found more than four arms encircling the head, but he has since discovered six in a single genus with which he had been long familiar by external characters. In this case the operculigerous lobe of the foot is quite cylindrical and of some length, bearing the peculiar operculum on its truncated extremity with the clawed process pointing to the left side. The sucker-disc is very small, and presents an anterior and posterior lobe. The two tentacula bear each an ocellus on the outer side near the base, and the ciliated arms, in every respect save number, resemble those of *Macgillivraya* and its congeners. The clawed operculum is developed from a spiral nucleus situate near the internal thickened border; it seems to be a weapon of defence, and is wielded with great dexterity by the little animal, which makes skips and jerks by means of its complex foot, after the manner of *Nassa* or *Strombus*.

The author notices another member of this diminutive tribe which is very commonly met with in the South Pacific, and has almost an indefinite range. As regards both animal and shell, it in many points resembles a miniature *Natica*. The shell is few-whorled, with small compressed spire and ventricose mouth; the operculum paucispiral and well-marked with the lines of growth. The foot is not unlike a broad and square-toed shoe in form, receiving or bearing the remainder of the animal and the shell. The shoe-upper, as it were, presents two rounded lateral lobes which lie over the anterior part of the shell, like the mentum of *Natica*. The little animal creeps on its foot with great rapidity, appearing rather to slide along than progress by a vermicular movement, and by spreading out and hollowing this organ at the surface of the water, as a freshwater Lymnæad forms a boat of its foot, it buoys up its tiny body and is cast abroad on the face of the ocean.

"On the Anatomy of *Nautilus umbilicatus*, compared with that of *Nautilus Pompilius*" By John Denis Macdonald, Esq , R.N.

During a visit of H.M.S.V. 'Torch' to the Isle of Pines in July 1854, a recent specimen of *Nautilus umbilicatus* was picked up on the outer reef off Observatory Island. It was alive when brought on board, but was too much exhausted to exhibit active movements. Part of the hood appeared to have been eaten away behind by some predaceous enemy, but in other respects the animal was perfect.

The body when retracted lay more deeply in the shell than that of *N. Pompilius*, so that no part was visible in a lateral view, and on account of the great depth of the chamber of occupation the orifice of the siphuncle in the last septum could not be seen when the soft parts were removed As to this difference, however, the author observes that it may depend on the time elapsed since the formation of the last partition.

Apart from the shells, the author finds a close resemblance between the corresponding parts of the two species.

The specimen of *N. umbilicatus* examined proved to be a female; a fact which may serve to modify the views of those who, adopting the speculations of D'Orbigny on the sexes of the Ammonites as indicated by the characters of their shells, apply them also to the several kinds of *Nautili* known.

The body of *N. umbilicatus* is larger and more elongated than that of *N. Pompilius* as it occurs in the South Seas, although the specimens of the latter species brought from the Chinese Seas much exceed both in size. In the *N. umbilicatus*, the longitudinal lamellæ on the median lobe of the external labial processes are divided by a wide groove into two lateral sets, and the corresponding lamellæ between the internal labial processes are about seventeen in number and of considerable thickness. In *N. Pompilius*, the latter lamellæ are much thinner and more numerous, and the lateral sets of the former are united together in the median line, commencing anteriorly with an azygos transverse lamina. In both kinds, however, the corresponding tentacula may be distinctly traced out, with only such minor differences as might be expected to occur in different specimens of either separately; the digital, labial and ocular groups agreeing sufficiently both as to number and character in the two cases, considering the liability of these parts to slight modifications, from arrest of development or redundance, in the same species.

Referring to former observations of his own on the eye of *N. Pompilius*, the author observes that they closely apply to *N. umbilicatus*, which affords confirmation of his opinion that the pigmentary coating is subjacent to the retina. He finds no vestige of a lens, and in place of vitreous humour, a mere viscous matter protecting the retina from the sea-water.

The organ of hearing, which had escaped detection in the specimen of *N Pompilius* dissected by Professor Owen, altered as it doubtless had been by long immersion in spirit, was discovered in the example of *N. umbilicatus* examined by the author. It consists of two spheroidal acoustic capsules placed, one on each side, at the union of the supra- and subœsophageal ganglia, and measuring about one-twelfth of an inch in diameter. Each capsule rests internally against the nervous mass, and is received on its outer side into a little depression in the cephalic cartilage. It is enveloped in a kind of fibrous tissue and filled with a cretaceous pulp consisting of minute, elliptical, otoconial particles, presenting under a high power a bright point near each end, varying much in size, and sometimes combined into stellate, cruciform or other figures. Cilia were not observed within the capsules.

The inside of the mouth is furnished with three groups of papillæ, one of which occupies the median line between the orifice of the tongue-sac and commencement of the œsophagus. These lingual papillæ, as well as the rest, are clothed with long and slender columnar epithelium-particles

The author agrees with Mayer in regarding the well-known follicular appendages of the afferent branchial vessels of the Cephalopoda, as performing the function of kidneys, but admits that they may also serve, by altering their capacity, to regulate the amount of blood passing through the branchiæ under changes of pressure to which the animal may be subjected at different depths. These follicles are subcylindrical in form, and somewhat dilated at the free extremity, to which is appended a folded and funnel-shaped process of membrane which expands rather suddenly and presents a jagged border. They open by an oval or slit-like orifice into the afferent branchial vessels, on each of which, as Professor Owen has observed, they are disposed in three clusters. The outer membrane is smooth and glossy, homogeneous in structure, and sprinkled over with minute, rounded, transparent bodies, resembling the nuclei of cells. Beneath this layer, flat bundles of fibres, apparently muscular, are traceable here and there, principally disposed in a longitudinal direction, and sometimes branched. The lining membrane consists of a loose epithelial pavement, similar in many respects to that of the uriniferous tubules of the higher animals, the cells containing, besides the nuclei, numerous minute oil-globules, or a substance much resembling concrete fatty matter. This membrane is thrown up into very numerous papillæ and corrugations, so as greatly to increase the extent of surface. The papillæ are more numerous towards the attached end, and a circlet of longitudinal folds, with transverse zigzag corrugations, radiate from the bottom of the follicle, in which a number of small pits or fenestrations are sometimes visible. The funnel-shaped membranous process above noticed is continuous with the lining membrane. The cavity of each follicle, therefore, communicates with the exterior through the centre of this process, and the aperture is thus guarded by a kind of circular valve permitting the escape of secreted matters, but effectually preventing the entrance of fluid from without.

Some considerations are next offered in support of the view adopted as to the functions of these vascular appendages.

Lastly, on the question whether the peculiarities of structure recognized respectively in *N. Pompilius* and *N. umbilicatus* are sufficient to establish a difference of species, or are attributable merely to variety, the author observes, that any tendency in a being to revert to an original type, when such has been determined, betrays variety; but this tendency is never manifested in the *Nautili* under consideration by the occasional occurrence of specimens presenting characters which place them intermediately between *N. Pompilius* and *N. umbilicatus*. Having visited the Fiji Islands since he formerly wrote on *N. Pompilius*, he finds that the umbilicated *Nautili* are not known to the natives, although *N Pompilius* is very plentiful; but at Fatuna or Wallis's Island, where both are found, the people recognize the difference between them depending on the presence or absence of umbilical pits. On this the author remarks, that although particular localities, with all attending circumstances, may favour the production of varieties, yet the permanence of the distinctive characters of these *Nautili* without symptom of amalgamation, and the discovery of a female specimen of *N. umbilicatus*, are strong arguments in support of the view that they are distinct species, though very closely allied.

LINNÆAN SOCIETY.

June 20, 1854.—Thomas Bell, Esq., President, in the Chair.

Read the commencement of a paper "On the Structure of the Seed and peculiar form of the Embryo in the *Clusiaceæ*." By John Miers, Esq., F.R.S., F L.S. &c.

The author stated it to be his object to direct the attention of botanists to the structure of the seed, and particularly of the embryo in this family, the nature of which had been hitherto quite misunderstood. During his residence in Brazil he had made several observations on the *Clusiaceæ*, which he hoped would assist in defining the characters and limits of the genera, hitherto very imperfectly described. These more general remarks would be reserved for a future occasion, his object being now confined, as a matter of primary importance, to the consideration of the seminal structure observable in this family.

He began by tracing a history of the facts and conclusions recorded on the subject. The earliest is that of Jussieu in 1789, where, in his ordinal character of the *Guttiferæ*, he states that the embryo is erect, without albumen, and with hard corky cotyledons, a character probably drawn only from *Calophyllum*. Gærtner next figured the analysis of three species of *Garcinia*, and described the seed as having a coriaceous testa, a thin integument, and a solid fleshy nucleus exhibiting in its axis a different development of a terete form, the whole constituting one compact inseparable mass: from these facts he concluded, contrary to the opinion of Jussieu, that the great body of the nucleus is a large albumen, and that the axile portion is a pseudo-monocotyledonous embryo, all closely united together in one solid body. Richard, in 1811, figured the analysis of the seed of *Clusia palmicida*, and it is singular that although the structure of *Pekea* (*Caryocar*) *tuberculosa*, described at the same time, has been copied into every botanical work since published, the equally important facts recorded of the seed of *Clusia* have entirely escaped the notice of every succeeding botanist except Jussieu. Richard there correctly describes the seed of *Clusia* as being enveloped in pulp, one extremity of its brittle testa pierced with an aperture, beneath which the nucleus exhibits a small protuberance cleft in two, which he states to be two minute cotyledons, the principal mass of the embryo being an enormous radicle: he points out the existence of an inner integument, one end of which is attached to the aperture in the extremity of the testa, the whole forming, in his own peculiar technology, "an epispermic antitropal embryo." Mr. Miers states there is one essential error in this otherwise correct description; that, like other botanists, Richard has mistaken the base for the apex of the seed. Jussieu, commenting on these facts in 1813, infers that *Clusia* cannot belong to *Guttiferæ*, but must constitute the type of a distinct family near *Marcgraaviaceæ*. Choisy, in 1822, in a memoir on the *Guttiferæ*, ascribes in his ordinal character, features different from those of Jussieu, and equally opposed to those of Gærtner. He states that the seeds are without albumen, that the embryo is erect, and that the cotyledons are large, fleshy, either separable, or combined in one mass. In *Garcinia*, he says, the seeds are arillate, and the cotyledons thick and conjoined; but in *Clusia*, he concludes that these presumed cotyledons are separable, a feature which no succeeding botanist has verified. He alludes in no way to the very different structure of the seed in *Clusia*, as recorded by Richard, although, when stating the separability of the cotyledons in that genus, this idea may probably have been derived from some indistinct recollection of the analysis of that eminent carpologist. In the 'Prodromus' of DeCandolle (1824), the characters given of the *Guttiferæ* are only a recapitulation of the facts stated by Choisy in the above-mentioned memoir. Cambessèdes, in a very able essay published in 1828, affirms that in the *Guttiferæ* the embryo is erect, the cotyledons large, thick, very entire, and united into one mass; the radicle is very small, of a nipple-like form, while its direction in regard to the point of attachment of the seed is deserving of attention, because this character (generally of primary importance) is here variable. He then states that in *Clusia criuva* the radicle is directed to the extremity of the seed farthest removed from the point of its attachment; he describes the embryo of *Clusia* and *Calophyllum* as being erect and inverted, the small mammæform point, which he calls the radicle, being at the apex, or opposite extremity to the basal point of attachment, while in *Mammea* and *Messa* the small radicle points in a contrary direction, *i. e.* to the basal point of attachment. He therefore erroneously concludes that in this family the embryo is either homotropal or antitropal, or in other words, is sometimes directed to that point of the seed next the hilum, at others towards the opposite extremity. These statements, it will soon be seen, are founded in error. In the following year, M. Cambessèdes, in describing the Guttiferous plants collected by A. St. Hilaire in Brazil, details the structure and position of the seed in *Clusia* in still more minute and positive terms; but Mr. Miers states that little dependence is to be placed on such definitions, especially in regard to the terms *base* and *apex* of the seed, because in the figures there given the seed is placed in a position diametrically opposite to that in which it is attached to the placenta, and there is therefore an evident misconception of the whole structure. Von Martius, in his admirable work on the plants of Brazil, gives no account of the structure of the seed of the many Guttiferous genera he there details, but he describes minutely the seed of *Platonia insignis*, where the nucleus, enclosed within the testa, is stated to consist of a large mass of fleshy albumen, having in its centre a long terete embryo with a superior radicle, the whole consolidated into one integral inseparable mass. As this form of embryo was opposed to the general conclusion of botanists in regard to the structure of the seed in *Clusiaceæ*, he suggested the propriety of placing the genus *Platonia* in a distinct family, which he called *Canellaceæ*, thus associating it with *Canella alba*, a plant very different in habit and floral structure, and of which little is known of its carpological structure. Endlicher, in his 'Genera Plantarum,' gives the character of each genus of the *Clusiaceæ* in accordance with the views of Cambessèdes, and arranges *Platonia*, following Martius, in the *Canellaceæ*, as a suborder of *Clusiaceæ*. Pöppig, in describing several Guttiferous plants of Peru and Brazil, gives no account of the structure of the seed. Lindley in his 'Vegetable Kingdom' adopts the views of Cambessèdes in regard to the *Clusiaceæ*, at the same time that he admits *Platonia* as a member of that family. Miquel, describing in 1844 a species of *Arrudea*, in like manner misconceived the structure of the seed, attributing to it an embryo with plano-convex cotyledons and a very short radicle. Lastly, Choisy, in a more recent memoir (1850), while he treats at some length on the organography, affinities, and subdivisions of the *Guttiferæ*, and gives differential characters of the several genera of the family, nowhere alludes to the structure of the seed, which is the more remarkable, because the facts published in the thirty years elapsed since his first memoir are completely at variance with his former views on the subject.

Mr. Miers then proceeds to give the results of his own observations on the structure of the seed, selecting first that of a species of *Clusia*, closely allied to *Clusia criuva*, upon which Cambessèdes principally relied in the construction both of his ordinal and generic characters of the family. The seed-vessel is here described as being formed of five fleshy valves, which break away from a central five-winged persistent column, in the angular recesses of which several seeds are horizontally attached in two longitudinal rows. Each seed is about an eighth of an inch in length, is oval, slightly gibbous on the upper side, the lower or ventral face presenting a prominent keel, extending from the base to the apex; the external tunic is fleshy, of an orange colour, and easily scraped off, when beneath the keel is seen a conspicuous raphe, one end of which proceeds from the basal point of attachment and terminates in the apex, where it is lost in an aperture seen in the crustaceous shell of the seed; this aperture is in the centre of a radiately striated cup; the shell is striately-punctate outside, smooth inside, and is lined with a free membranaceous integument, contracted at its summit into a narrow neck of a darkish colour, by which it is suspended from the extremity of the raphe-like cord that has penetrated through the apical aperture: a solid nucleus filling the cavity of this inner integument is of a pale-green colour, marked by numerous parallel yellow striæ which cease around an areolar space at the base, in the middle of which is seen a minute shining tubercular point: the apex of the nucleus is distinguished by a short hemispherical nipple-shaped protuberance of a smaller diameter, which is divided to its base by a distinct transverse cleft into two equal portions, the bottom of this commissure on the ventral side corresponding with the dark-coloured neck of the inner integument, as well as with the somewhat lateral aperture in the summit of the outer shell, and with the termination of the cord described; on making a longitudinal section of this nucleus, the cleft above-mentioned is more distinctly seen, and at the bottom of the commissure is observed a minute prominent point, and in the axis extending from this point to the small tubercular speck at the base, there is observed a continuous line, more or less narrow, somewhat curved, more opake and of a whiter colour than the rest of the nucleus, the principal fleshy mass being of a semicrystalline hue. This internal thickened line is what Gærtner considered to be the embryo of the seed, and the fleshy surrounding mass to be copious albumen. Choisy, Cambessèdes, and most other botanists have considered the main body of this nucleus to be two large cotyledons agglutinated into one solid mass, the line of their junction being indicated by the curved line just mentioned; while they held the nipple-shaped protuberance to be the radicle. Mr. Miers, however concludes, from the facts above described, that the seed is enveloped in a fleshy arillus, and exhibits between it and the testa a free raphe, extending along the ventral face from the point of its attachment at the placenta, to the apex, where it penetrates the cup-shaped ring situated near the summit of the testa, through a distinct hole in the bottom of the cup, and where it is lost in the apex of the inner integument in the centre of its distinctly marked chalaza. Another small cicatrix is observed at the opposite extremity of the testa, at a point near its attachment to the arillus and placenta, which must be considered as the micropyle. The distinct aperture in the summit of the testa through which the nourishing vessels of the raphe reach the chalaza, is called by the author the *diapyle*, in contradistinction to the micropyle observed at the opposite extremity of the testa.

The diapyle, in this and many other families, forms a distinct aperture filled with soft fungous matter; in other cases it is less discernible, being closed by the osseous deposits of the testa, and is only recognizable as the point where the extremity of the raphe becomes lost in its substance. The existence of the diapyle in connexion with the raphe and chalaza of the inner integument constitutes an important feature in this inquiry. The nipple-shaped protuberance in the summit of the nucleus, hitherto taken to be the radicle, appears beyond doubt (as first shown by Richard) to be the two cotyledons of the embryo, which though small and short, are nevertheless quite distinct, and their relative position is indicated by the cleft being placed right and left of the axis, or with their commissure pointing to the raphe. the main body of the nucleus, instead of being confluent cotyledons, as hitherto supposed, must be a gigantic radicle, in the axis of which is imbedded the caulicle of the embryo (or rather what, for reasons given in the paper, Mr. Miers distinguishes as the *neorhiza*), shown in the opake central line before mentioned, terminated at its base by the shining speck seen in the base, and at its apex by the plumule, which is seen protruding as a minute point into the space at the bottom of the cotyledonary cleft. The minute external speck seen near the base is considered by the author to be the germinating point of the *neorhiza*; it is always more or less prominent, of a green colour in the living state, and does not correspond exactly with the micropyle of the testa, but is always somewhat lateral in respect to it, and nearer the basal origin of the raphe.

The above analysis affords a good example of the general structure of the seed in the tribe *Clusieæ*, where a number of seeds are formed in each cell of the ovary, and where they are attached in a horizontal position by their base to the axile placentary column; but in the other tribes (*Tovomiteæ* and *Garcinieæ*), where only one seed is formed in each cell, and where this is fixed to the axile column in a vertical position by its ventral face, a somewhat different structure exists; and were it not for the explanation afforded by the former case, the structure of the embryo in the two latter instances would not be so easily understood. In the *Clusieæ*, the raphe enclosed within a fleshy arillus is seen to extend from the base to the apex of the seed, and is free from the testa; in the other tribes the testa is thinner, and enveloped in a thicker fleshy, or more pulpy arillus, has a large hilum upon its ventral face, the raphe being short, less discernible, imbedded and lost amidst the numerous branching nervures conspicuously extending over its surface. The author gives as an example of this development, the analysis of the seed of *Lamprophyllum lætum*, which he examined during his residence in Brazil: this forms the type of a new genus distinct from *Garcinia*, comprising numerous South American species, among them the *Calophyllum Calaba* of Linnæus, and others heretofore associated with *Garcinia* and *Calophyllum*. Here the fruit is a small drupe containing generally two, or by abortion a single seed, about the size of a hazel-nut, which is enveloped in mucilaginous pulp: the testa is thin and brittle, marked by numerous nervures branching from a large ventral hilum, and it contains a solid fleshy nucleus, exhibiting in the apex a very minute prominent nipple in a small hollow a little below the summit of the ventral face: near the base, somewhat on the dorsal side, is seen a green shining speck, exactly like that seen in the seed of the *Clusieæ*; the body of the nucleus is solid, of a pale sulphur colour, filled with numerous ducts or cells that exude a viscous juice when cut: a slender caulicular process, like that described in the *Clusieæ*, is seen somewhat oblique with the axis, one of its extremities terminating in the nipple, the other in the basal speck just described, the latter being without doubt the germinating point of the root, the minute apical nipple being the plumule, the main body of the nucleus forming a gigantic radicle, and the cotyledons at first sight appearing to be wanting; but on examining the minute nipple-shaped process under a strong lens, this is observed to be formed of four diminutive imbricated scales, surrounding a central prominent point, which is concealed by the two inner and larger scales; the two outer decussating leaflets, thus separated from each other, are smaller, shorter, and placed right and left of the ventral face, as in the cotyledons of the *Clusieæ*, from this circumstance, and from their commissure being directed to the ventral face, the author infers from analogy, that these outer scales are the true cotyledons of the embryo, notwithstanding their minuteness. Generally, in exogenous plants, the want of cotyledons indicates the future absence of leaves in the plants produced from the growth of such seeds. In the *Clusiaceæ*, however, where the floral structure is of the highest order of development, belonging frequently to the largest trees of tropical forests, with copious foliage, large fleshy leaves, and rich in mucilaginous juices, the absence of cotyledons, or their reduction to microscopical proportions, offers an anomaly suggestive of many considerations on the nature of vegetable reproduction.

This structure was found to exist in every instance in the seeds of the *Garcinieæ* and *Tovomiteæ* examined by the author; and he quotes the descriptions of Gærtner, Plumier, Graham, Roxburgh, and Wight, in proof of the same general conformation. All existing evidence, therefore, tends to prove the constant development in the axis of the solid nucleus of the seeds in all Guttiferous plants, of that peculiar process which the author considers to be the neorhiza; for our decision upon this point will determine in a positive manner, the nature of the other parts of the seeds to which such various conclusions have been assigned by previous botanists. This determination he considers to be proved by the drawings of Dr. Roxburgh and the evidence of Dr. Wight, where the seeds of *Xanthochymus* are figured in a state of germination: in a longitudinal section of the seed in this state, as shown by these accurate observers, the same linear process in the axis of the nucleus is depicted as that above described; the basal speck is there seen throwing out a long root, while the apical nipple-shaped process has simultaneously become prolonged, carrying up with it the leaflets of the growing plumule; and from the lower part of the neck thus protruded, and beneath the two lower scales shown to be the cotyledons, a second rootlet is seen sprouting, tending first horizontally and then downwards. This fact, the author states, proves beyond doubt, that the process in question is the neorhiza; for if it were the embryo imbedded in albumen, as Gærtner affirms, it would not throw a descending shoot from the neck of the plumular extension, as well as at the base; nor would the same result follow if it were the radicle enclosed in confluent cotyledons, according to the view of Dr. Graham. The fact is altogether fatal to the conclusions of Choisy, Cambessèdes, and most modern botanists, that the great mass of the nucleus consists of two confluent cotyledons, and that the mammæform apex in the *Clusiœ* is its radicle, even if those opinions had not been disproved by the evidence offered in the preceding portion of this memoir

This view of the constitution of the nucleus is further confirmed by an examination of its structure under the microscope, which the author minutely details.

November 7th.—Thomas Bell, Esq., President, in the Chair.

Dr. Alexander, F.L.S., exhibited a sample of Dalmatian Figs, together with specimens of vegetable fibre prepared in the Jamaica Botanic Garden from various species of *Yucca, Bromelia, Tillandsia, Musa*, and *Sida*, and the Secretary read extracts from two letters addressed by Mr. A. Wilson, Curator of the Botanic Garden at Bath, in the Island of Jamaica, to R. C. Alexander, M.D., F.L.S., &c., on the textile plants of the Island, native and cultivated. In the last of these letters, dated Bath, September 25, 1854, Mr. Wilson says:—"You are aware that we abound in textile plants: I have already prepared fibre from twenty different species, and perhaps I might discover twenty others. Those you mentioned, such as the *Urtica* tribe, produce excellent fibre, but not in quantity sufficient to warrant a profitable cultivation among a lazy people. I have lately been agreeably surprised to find so large a quantity of fibre from a species of *Sida* (*S. mollis*) growing in this garden. It is most admirably adapted for cultivation in any soil or situation. There is also another plant (a species of *Triumfetta*), which is a wayside nuisance, but which produces a splendid fibre. I should be obliged if you would exhibit these fibres to the next meeting of the Linnæan Society; it might be the means of attracting attention to a new and profitable cultivation in this unfortunate island. It was in consequence of the transmission to London of a very few species of fibre that attention has of late been so much drawn to our textile resources, and I think it a fortunate circumstance that we have those resources to fall back upon. It has occurred to me that I might, with advantage to the island, send about twenty species of fibre to the Great French Exhibition of next year, which would be a means of extending their reputation, and perhaps of inducing the investment of capital on a large scale in their cultivation."

Read also a Memoir "On the Embryo of *Nelumbium*." By Benjamin Clarke, Esq., F.L.S., &c.

Mr. Clarke's observations were made on seeds germinated in the

Royal Gardens at Kew, in various stages of advancement. His view of the embryo is, that the plumule is enclosed within two large amygdaloid cotyledons, with well-defined margins, which are distinct down to the attachment of the base of the plumule, or very nearly so; and there is also an obvious tendency to form a radicle, so that the embryo appears to conform fully to the ordinary dicotyledonous type. Then follows the membranaceous envelope and four leaves successively, which are alternate with the cotyledons, and in most cases there is a slight attempt to produce a fifth. The membranous envelope, or proper membrane of the plumule, consists entirely of cellular tissue, and has indistinctly the appearance of a leaf alternating with the first leaf above it. The first two leaves having laminæ are elevated in the young stem of the plumule, so as to be removed to some extent from the cotyledons, while the proper membrane arises from its very base, and might be described perhaps as being attached to the line of junction between the young stem and cotyledons It can have no connection with the first leaf of the plumule, a considerable portion of the axis intervening between them. Supposing it to be a stipule, it must be compounded of two, and those belonging to the cotyledons. This, however, the author thinks, will not be regarded as probable; he considers it without doubt as a rudimentary leaf of the plumule itself, for which opinion he gives several reasons. It is further remarkable that all the remaining four leaves of the plumule are furnished with laminæ, differing in this respect, Mr. Clarke observes, from those of the stem, where only one leaf in three ever produces a lamina. Of these four leaves of the plumule the first is without stipules; a farther proof, in Mr. Clarke's opinion, that the proper membrane is not to be regarded as a stipule Of the three succeeding leaves, the intra-axillary stipule of each, on being laid open, is found to contain the succeeding leaf. This stipule Mr. Clarke regards as compounded of two, one originating on each side of the petiole, united by their membranous margins within the axil of the leaf, as in *Pontederia* and *Potamogeton*. As regards the foliage of the plant, Mr. Clarke states that according to his view, three leaves only are produced on each node, and are attached so nearly on a parallel, that did they not successively enclose each other, they could not be distinguished from opposite leaves; of these the two outermost of each whorl consist only of membranous scales, without any rudiments of stipules, completely surrounding the third and perfect leaf. This leaf having a lamina, should, Mr. Clarke states, in common with those in the upper part of the plumule, have a large intra-axillary stipule, enclosing the terminal bud or growing-point, and this he finds to be obviously the regular structure. The flower appeared in one instance not to be terminal, but to be produced from the axil of the second scaly leaf, while the buds in the axils of the leaves with laminæ were leaf-buds. On the subject of affinity, Mr. Clarke thinks that the Nymphæal alliance, as usually limited, has no very near relationship except with *Ranunculaceæ*; but that much analogy exists between it and some Endogenous families, and that it may also be connected with *Cryptogamæ*, through *Ceratophyllum* and *Chara*, the embryo of *Ceratophyllum* showing a difference between its second foliaceous appendages as compared with those that follow, in analogy possibly with that of *Nelumbium*.

Read further, "Notes on *Cephaloteæ* and *Belvisiaceæ*." By Benjamin Clarke, Esq., F.L.S., &c.

In these two notes Mr. Clarke gives a general account of the structure of the remarkable plants on which the families are founded. The ovule of *Cephalotus* he describes as erect, anatropal, with a dorsal raphe, and a large and somewhat two-lipped foramen at the base, on the inner side of the funiculus. The torus in the ripe fruit is described as broad and conical, almost filling the calyx: during the stage of flowering it is almost flat, the carpels appearing to be attached to the flat base of the calyx. As the fruit advances in growth the conical torus forms between the carpels, to the sides of which they are attached, and after the carpels are fallen off, it forms a rim immediately above the part to which they were attached, not unlike the expanded style of *Sarracenia* in miniature, the rim, however, being comparatively much more contracted. The rim has six angles, which alternate with the attachments of the six carpels, and from the place of attachment of the carpels, or immediately above them, are formed six small filamentous processes. Mr. Clark considers this small peltate process as analogous with the expanded termination of the style in *Sarraceniaceæ*, and consequently regards the nearest affinity of *Cephaloteæ* as being with that order. In other respects he considers it as very nearly allied to *Francoaceæ* and *Ranunculaceæ*, and thinks it shows some analogy with *Aristolochiaceæ* in the glands of its calyx. It approaches *Rosaceæ* in its perigynous stamens, and in the position of its raphe, if the ovule pendulous with raphe next the placenta be regarded as an equivalent character.

In his note on *Belvisiaceæ*, Mr. Clarke describes the ovary of *Napoleona* as five-celled, the ovules as two—four in each cell, when two suspended, when four in pairs one above the other, and (in an early stage at least) nearly horizontal; when suspended amphitropal, with the raphe dorsal and the foramen turned up nearly to the base of the ovule, so as to be distinctly under the funiculus; the style thickened, more or less hollow below, and terminated above by a broad peltate plate, forming the stigma; the stigmatic surface confined to five small elevations in the five angles of this plate, within which are five cavities opening upwards; and the stigmatic surfaces apparently opposite to the cells of the ovary. He states the principal points of structure which may be regarded as indicative of affinity to be, first, the acicular woody fibre, in which *Napoleona* agrees with *Clusiaceæ* and *Rhizophoreæ*, particularly the former; secondly, the table-shaped stigma, which he states to be almost peculiar to *Clusiaceæ* and their allies, and this character, he thinks (as well as the monadelphous extrorse stamina), separates *Belvisiaceæ* from *Myrtaceæ*; thirdly, the dorsal raphe (or at least the resupinate position of the ovules), in which they agree with *Ternstrœmiaceæ* and *Barringtoniaceæ*, where the ovules are few and suspended, but differ from *Rhizophoreæ*, where the raphe is next the placenta. The balance of affinities is therefore, in Mr Clarke's opinion, towards *Clusiaceæ* and *Ternstræmiaceæ*.

November 21st.—Thomas Bell, Esq., President, in the Chair.

Read the conclusion of Mr Miers's "Observations on the Structure of the Seed and peculiar form of the Embryo in the *Clusiaceæ*," commenced on the 20th of June.

The author proceeds to offer some observations on the nature of the external covering of the seed, which is considered by him to be an arillus. In the *Clusieæ* this is entire, without the smallest fissure, is fleshy, of equal substance, not very thick, and generally of a reddish-yellow or orange colour. In the *Tovomiteæ* it is slit upon the dorsal side from top to bottom, the fimbriated edges overlapping each other, so that when opened out, it appears like a flat sheet with the seed attached in its centre. In the *Garcinieæ* the arillus is much thicker, of pulpy or mucilaginous substance, generally edible, and quite entire, as in the *Clusieæ* The nature of this outer covering in the two last tribes cannot be questioned, and it is fair to conclude that the precisely analogous development in the *Clusieæ* is also a true arillus. It is however essential to determine this point beyond cavil, because in the *Hypericaceæ*, *Marcgraaviaceæ*, and other orders, it has been held to be a thickened epidermis of the testa, while in the *Magnoliaceæ* it has been assumed to be the testa itself In the latter family, where the seeds are suspended by long funicular threads, it forms a very conspicuous development, under the form of an entire fleshy scarlet-coloured covering, precisely like that of *Clusieæ*, and where in like manner within it, on one side, is seen proceeding from the base to the apex a flattened raphe, whose upper extremity is lost in a fungous spot filling the cavity of a distinct aperture pierced through the osseous shell, which by most botanists has been considered to be the testa, but which by some has been held to be the inner integument of the seed, called *tegmen* by Mirbel, and *endopleura* by DeCandolle. Endlicher was the first to suggest this idea, which he expresses ambiguously, stating that the seeds of the *Magnoliaceæ* have in most cases "an external fleshy integument covering a crustaceous testa, with a raphe situated between it and the testa, and terminated by a chalaza on the summit, but that sometimes there is no outer integument, the raphe in such cases existing between the testa and endopleura." Mr. Miers considers that this misapplication of the term chalaza (a name that should be confined to the peculiar thickening of the inner integument where it unites with the raphe, around the point where all farther trace of the continuation of the nourishing vessels ceases), where evidently it has been confounded with the diapyle, has probably led to the error of regarding the true testa as the tegmen of the seed. Dr. Asa Gray, however, in his 'Genera of the United States,' amplifies this suggestion of Endlicher in unequivocal terms, stating that in *Magnolia* the seed has no arillus, and he designates as the testa the external scarlet covering which preceding botanists call arillus, while the hard crustaceous shell called testa even by Endlicher, is there denominated tegmen. This he infers from the fact of having observed spiral vessels in the placentary attachment of the ovules, which he thinks "clearly demonstrates that the baccate exterior integument of the seed is formed of the primine of the ovule, and therefore is not an arillus" Had the growth of this tunic been actually traced from the primine of the ovule, an important fact would have been established; but simply because the primine is the more exterior tunic of the ovule, and the arillus is the external coating of the seed, it does not necessarily follow that the one is the product of the other, and notwithstanding the argument of Dr. Gray, there is no reason to doubt that in *Magnolia* the scarlet envelope is due to a subsequent growth over the primine, as occurs in numerous well-known cases. Mr Miers is confirmed in this view by observations which he made in Brazil upon living seeds of *Talauma*, a genus closely allied to *Magnolia*.—First, he found the thick outer tunic to consist of fleshy or oily matter, in distinct granules, enclosed within a thin external epidermis, which is the usual texture of arillus, not of testa. Second, the coating called tegmen by Dr. Gray, and considered by him as the innermost integument, is in reality the intermediate envelope in *Talauma*. it has a small basal hilum, a longitudinal furrow runs along its ventral face for the reception of the free raphe, and a brown fungous scar through which the raphe finds a passage to the interior, fills a distinct aperture near its apex (the diapyle), which Dr. Gray, following the example of Endlicher, considers to be the chalaza; this crustaceous envelope is thick and osseous in texture, bearing all the characters of testa, certainly not of an innermost integument of the seed. Third, the existence of an inner membranaceous integument around the albumen, and within the true testa, thickened and discoloured round its summit, where it is attached by a short neck to the fungous process that fills the diapyle, and where it unites with the raphe, is a development wholly unnoticed by Dr. Gray, by Endlicher, or by DeCandolle, although the presence of this integument is indicated by Gærtner, but it is an important feature, because it proves that the bony coating is the testa, and not the tegmen, as has been inferred. Fourth, the raphe proceeding from the hilum is wholly exterior to and free from the bony coating, and interior to the outer tunic, and this is the constant position of the raphe when it is free, in regard to arillus and testa, assuredly not in respect to testa and tegmen. Fifth, as the raphe consists of the nourishing vessels originally existing in the funiculus or placentary attachment of the anatropal ovule, it could never have existed between the primine and secundine, but must have been, as Dr. Gray figures it, wholly exterior to the primine, and consequently, as we afterwards find it, outside the testa, which is a product of the primine; hence as the raphe is found in a free state, though partially impressed in its soft substance, within the external tunic, the inference is irresistible, that the latter must be of posterior growth (therefore of the nature of an arillus), and in this manner enclosing the raphe within it. Sixth, we have thus the evidence complete of the existence of the usual and distinct envelopes around the nucleus of the seed, viz. an inner integument with its apical chalaza, an intermediate hard testa with its corresponding diapyle, through which the nourishing vessels of the more exterior raphe penetrate, and the whole included within a scarlet-coloured arillus.

From all these facts it may be inferred, that the envelope, which unquestionably is an arillus in the *Garcinieæ* and *Tovomiteæ*, must be of the same nature in the *Clusieæ*, and that which is arillus in the *Clusieæ* must be the same development in the *Magnoliaceæ*; that which is granted in the one, cannot, Mr Miers thinks, be denied in the other. Although it be true that the several envelopes of the seeds in different families are not to be recognized alone by their consistency, which may be more or less membranaceous, ligneous, cellular, or composed of oily or resinous granules according to circumstances, yet they may always be determined by their relative position in regard to raphe, chalaza, diapyle, micropyle, hilum, &c.

Connected with this question is that of the origin and mode of growth of the arillus in seeds, which by St. Hilaire is described to be of two kinds, the true and the false arillus, the former open at its extremity, the latter entirely covering the seed. This view was afterwards modified by Dr. Planchon, who gave to the false arillus the name of arillode. Both kinds are alike in texture, form, and colour, their difference consisting in this:—the arillus, whether abbreviated or entire, always covers the micropyle of the testa, while the arillode constantly exhibits a minute or larger opening in its surface around the micropyle, which is never covered by it. He traces this distinction to their different sources of origin, attributing the growth of the true arillus over the ovule to a gradual enlargement of the funiculus, noticing its first appearance from a mere swelling of the umbilical cord to its gradual increment and ultimate development; but the arillode, he states, is derived from an enlargement of the mouth of the exostome or foramen of the ovule, its margins being reflected and produced over the primine, thus growing upon it in the form of an additional tunic. In either case, it is, therefore, clear, whether this accessory coating be arillus or arillode, that the raphe, when it is free, must necessarily be enclosed within it. In *Euphorbiaceæ* this coating is considered by many botanists, Dr. Planchon among the number, as merely an epidermis of the testa, but it becomes difficult to discriminate between a very thin arillus and a thick epidermis, as both appear to be of the same nature, varying in degree of thickness from one extreme to the other in different genera of that family. The most instructive and conclusive evidence of the origin and subsequent extraneous growth of the arillus over the ovule, has been adduced by Cambessèdes, who found in *Casearia* many incomplete seeds where the anatropal ovule remained in a state of complete abortion, while the arillus had grown over it to its full extent, proving that where the ovule had ceased to grow, the increment of the funiculus was not stopped in its progress of extraneous development. According to the hypothesis of Dr. Planchon, the outer tegument in the *Clusiaceæ*, as well as in the *Magnoliaceæ*, must be a true arillus.

The facts thus demonstrated will, Mr. Miers argues, necessarily change our views of the affinities of the *Clusiaceæ*, serving to bring the order into close proximity with the *Rhizobolaceæ*, a relationship long ago pointed out by Cambessèdes, founded upon their floral structure, but now rendered more evident by the great similarity observable in their extraordinary embryonal development. The latter family exhibits likewise an embryo with a gigantic radicle, and exceedingly small cotyledons, but here these are separated from the radicular body by a slender free caulicle or neck; now if we imagine the suppression of this caulicular extension, and the close approximation of the minute cotyledons to its monstrous radicle, there would be little or no difference in the structure of the embryo in the two families. While these circumstances tend also to draw closer the affinity of the *Clusiaceæ* to the *Hypericaceæ* and *Marcgraaviaceæ*, they tend to remove them far from the *Ternstrœmiaceæ*, with which order they have been hitherto considered to be most intimately related. The farther consideration of the real affinities of the *Clusiaceæ* will be more fully examined by the author, who intends on a future occasion to treat of the organography, floral structure, and generic features of the whole family, restricted within the limits he proposes.

ZOOLOGICAL SOCIETY.

January 10, 1854.—H. F. Walter, Esq., in the Chair.

Notes on the Habits of Indian Birds.—Part I. By Lieut. Burgess.

Order I. Raptores

Family Vulturidæ.

Genus Vultur.

Vultur Pondicerianus. Black Vulture.

This Vulture, as far as I have had opportunities of observing it, is much more common in the Deccan than either the large (*Vultur Indicus*) or the small brown Vulture (*Vultur Bengalensis*). I have never, however, seen more than two or three together, and these generally in the neighbourhood of the low ranges of hills which intersect that part of the country. As this bird has doubtless been already figured, it is not my purpose in these notes to enter into any further description of it, but merely to state what I have observed of its habits, food, manner and time of nesting, with any other information regarding it which I may have gained by actual investigation, or learned from credible sources. In its habits the Black Vulture, I should certainly say, is not gregarious; I do not remember to have seen more than four or five together, and then it has been for the purpose of partaking of a social meal. It flies in circles with the wings extended, apparently without motion, and their tips pointed upwards, the legs being stretched out beneath the tail The food of this Vulture consists of decaying animal substances; one which I shot drinking in a stream disgorged the entire leg of a cat. They breed during the months of February and March In my notes taken at the time, I find the following:—"March 7 Found to day, on the top of rather a low peepul (species of banian tree), the nest of the Black Vulture, on which one of the old birds was sitting. The nest, which was very large, was built of small sticks, it contained one egg. On the same tree a pair of the Black-headed Ibis (*Tantalus melanocephalus*, Lath.) had also built their nest; it contained four white eggs, very similar to those of the Pelican Ibis (*T leucocephalus*) "—"March 19. Shot a male Black Vulture sitting on one egg; the nest was about a yard in circumference, built on the top of a thorny tree; it was composed of the thorny branches and other sticks below it. Among the thorny twigs forming the nest were two small nests, belonging to birds of the Passerine order, containing young" In both these cases only one egg was found, of a pure white colour, $3\frac{8}{10}$ inches in length by $3\frac{1}{20}$ inches in width. In a third also, only one egg was found. The natives say that the Black Vulture lays two eggs, containing a male and female bird, but these facts seem opposed to such a statement.

Genus Neophron.

Neophron percnopterus Egyptian Vulture.

This is the most common and most efficient scavenger to be found in the cantonments of India. The last-mentioned Vulture feeds only, I believe, on decaying animal substances, but this bird usurps the place of the night-cart, removing the filth that would otherwise cause pestilence under a tropical sun. Any one who has been in India must have observed these disgusting-looking birds, from the young in its black to the mature in their white plumage, stalking with awkward gait in troops about the plains which generally surround an Indian military station, and no one can mistake the errand on which they are there. They breed during the months of February, March, and probably April. I have found their nests most frequently during the month of March The nest, of a large size, is composed of sticks, in one case it was lined with rags and other refuse. It is generally built on tall trees, especially the banian. I found one on a ledge of rock on the side of a steep hill. The eggs are in general two in number, varying very much in colour, from white spotted with brown to a universal rust or liver-brown, darkest at the large end, $2\frac{7}{10}$ inches in length by $2\frac{1}{20}$ inches in breadth. One nest contained two eggs, one nearly white, the other equally brown. The young when first hatched are covered with a whitish-brown down, the down being whitest on the oldest. I give a description of a young bird brought to me on the 15th of April: "Beak and naked skin under the chin and about the gape and beak, dull greenish lead-colour, that over the eyes and on the forehead, lead. Irides dark; a white spot of down on the crown of the head; feathers on the neck and upper part of the body tipped with ferruginous; back upper tail-coverts dull white, tipped with fawn; tail-feathers dull whitish fawn; lesser coverts whitish, tipped with ferruginous brown, quills greenish-black, legs and feet dull lead-colour, middle toe very long." In notes taken at the time, I find an entry that I saw an Egyptian Vulture on her nest as late as the 4th of May.

Family FALCONIDÆ.

Subfamily AQUILINÆ.

Genus AQUILA.

The eggs of the Eagle forwarded with these notes are those, I believe, of *Aquila fusca*, Gray (identical I imagine with *Aquila nævia*, Gould), because that bird is by far the most common of the family in that part of Western India situated above the Ghauts. In the hilly portions of the country this bird may be seen perched on some elevated point of rock, sitting motionless, basking in the rays of the early sun; in the plains a solitary tree is almost sure to have one of them on its topmost branch. After the sun has been up some two or three hours, it commences its search for food, consisting chiefly, I believe, of hares. A Mharatta of high family, who had a very considerable knowledge of the habits of the birds of the country, told me that when an eagle discovers a hare in her form, which is generally in the grass at the foot of a bush, she will strike the bush with her wings to drive her victim out, before striking at it. That a large portion of this eagle's food consists of hares, I can attest, having found their skulls and bones in a nest The nest, of a large size and composed of sticks, is built on tall trees, it contains two eggs, $2\frac{7}{16}$ inches in length and $2\frac{1}{16}$ inches in breadth, of a white ground, sprinkled over with reddish spots. They commence breeding as early as the latter end of November, and their eggs may be found up to the beginning of April.

Subfamily CYMINDINÆ

Genus ELANUS.

ELANUS MELANOPTERUS.

I was never able to procure the nest and eggs of this handsome little Kite, but A. F. Davidson, Esq., of the Revenue Survey, a great sportsman and accurate observer of birds, told me that he obtained a young bird of this species and two eggs. The eggs were of a pure white colour, and about as large as the egg of the Indian Blue Pigeon. They were laid during the month of December. The stomach of one of these birds contained a rat.

From the colour of the eggs, and the manner in which the radiating hairs between the eye and beak meet over the ridge of the beak, it has struck me that this bird approaches nearer to the family of the Harriers than that of the Kites. Dr. Jerdon, in his notes, also says that "it frequents long grass and grain fields, over which it may be seen to hover like the Kestril."

Subfamily Buteoninæ.

Genus Milvus.

Milvus affinis. Common Indian Kite

This is one of the most common, if not the commonest bird of prey to be found in India. Over every cantonment, town and village they are to be seen, sweeping round in graceful circles, ever and anon making a swoop, as their quick eye descries some offal thrown out from cook-room or hut, seizing it in their claws without alighting, and making their repast on the wing. So sudden and bold is their dash, that in two cases which occurred amongst my own servants, a Kite pounced on the contents of a plate which a servant was bringing from the cook-room, and was off almost before the man knew who the thief was, and whence he came. On another occasion the theft was not confined to meat, for either a silver fork or spoon was thus whipped up, and the thief, after being chased by the affrighted servant, and scared by his shouting, dropped it in a neighbouring garden. The poor servant doubtless thought that a Kite would never be suspected of having committed the theft. The food of this bird consists of every kind of animal refuse; and in providing two such efficient scavengers as this Kite and the Egyptian Vulture, in a country where all animal matter begins at once to decay and would form a constant source of pestilence, the hand of an all-wise and gracious God is clearly visible. The common Indian Kite builds its nest on tall trees, during the months of February, March and April. I saw a bird building as late as the 18th of April. The nest is composed of sticks, and contains as many as three eggs I never found more than that number. The eggs are $2\frac{3}{20}$ inches in length and $1\frac{13}{20}$ inch in breadth, varying a good deal in colour, but generally of a whitish ground, more or less blotched and spotted with reddish-brown, in some the markings are chiefly at the large end, in others at the small

Milvus Pondicerianus. Brahminy Kite

The eggs of this fishing Kite I have never seen, but I transcribe a note of its nest and young: "Feb. 27, 1850. Found the nest and two young birds of a species of fishing Hawk; the young ones were covered with whitish down, that on the back of a pale brown colour. The nest, formed of sticks and lined with mud, was built on a tall tree on the banks of the Bheema River, where these birds are common." As far as my observations go, I should say that this bird is decidedly a fishing Hawk. I have never seen it but either sailing along the course of a river or in the vicinity of water.

Genus Pernis.

Pernis cristata?

I have not been able to ascertain anything relating to the nesting or the eggs of this Buzzard, but I was informed by a Mhar who saw it, of a curious habit of this bird, that when about to feed on a comb, these birds spread their tail, and with it drive off the bees before attacking it. This was told me by a villager in a portion of thickly-wooded country where these birds are common.

Genus Buteo.

Buteo Teesa, Gray.

This is one of the commonest Hawks in the Deccan. Its plaintive cry may be heard in almost every tope of trees. It is easily distinguished by its white throat and silvery-white eyes. Dr. Jerdon, in his 'Catalogue of Birds of India,' says: "It frequents topes as well as open country, where it may be seen seated on low trees and bushes, an ant-hill, or the banks of rivers, whence it pounces on mice, lizards, small snakes, and various large insects and their larvæ." In the stomach of one of these birds I found a small snake entire, said to be of a very venomous kind, and a large locust, in that of another the remains of a full-grown rock quail. I am not aware whether the eye of all or most of the *Falconidæ* is strengthened by a ring of bony plates, as is the eye of the Golden Eagle, but it is the case in this bird. The Teesa breeds during the months of March, April and May The nest is composed of sticks laid on the forked branches of the babool, mango and other trees. It sometimes contains as many as four eggs, $1\frac{8}{10}$ inch in length and $1\frac{5}{10}$ inch in breadth, white, spotted and dashed with brown.

I am very much inclined to think that the Teesa migrates during the monsoon, and returns to the Deccan about September, as I used not to hear its peculiar cry from the end of May to the middle of that month. Mr. Elliot, in his notes, mentions that *Circus cyaneus* and *Falco peregrinus* also migrate during the hot season and monsoon. I never noticed any of the Harriers about until September or October. The name of the Teesa in Mharata is 'Surudmar,' and in Hindoostani, 'Girgootmar,' meaning in both languages, I believe, 'the destroyer of lizards' This name also applies, or is applied, to the Kestril Blackwing (*Elanus melanopterus*), and Harriers.

The eggs sent with the others, I believe are those of one of the Harrier family, but of which I am unable to say. Most probably they belong to *Circus cyaneus* or *Circus Montagui*, as these are the most common. *Circus cyaneus* (*C. pallidus*, Sykes) is exceedingly common in the Deccan. In the grass lands amongst the hills, where quails abound, I have observed these birds beating particular spots of ground in the most regular manner, and when shooting, have found such spots to yield the best sport. I was told by a gentleman of the Civil Service, an ardent sportsman, that when shooting near Belgaum, many of the quails have been carried off by the Harriers before the beaters had time to secure them They will fly over a plot of grass land, scanning every foot of it, and in the most careful manner beat the hedges and strips of bush and grass between the fields. They feed on lizards, mice, and small birds. I have been told that these birds remain to breed in the Deccan.

Subfamily FALCONINÆ.

Genus FALCO.

FALCO LUGGUR.

Of the true Falcons, the Luggur is the most abundant on the table-lands of Western India. The top of a tall tree in the midst of cultivation is its favourite resort. It breeds during the months of March, April, and probably May, making its nest, like that of all the birds of prey, of twigs and sticks on a tall tree, and lays four eggs, $1\frac{9}{10}$ inch in length, and $1\frac{6}{10}$ inch in breadth, of a reddish-white ground, spotted with two shades of reddish-brown, and thickly mottled with red-brown at the larger end; some are of a more yellow colour. As the plumage of the young birds has been already noted, any further description is unnecessary. In the stomachs of two birds of this species I found the remains of lizards.

FALCO CHICQUERA.

This handsome little Falcon is also common in Western India. It is a bird of rapid flight, and peculiarly active and energetic in all its movements. The natives told me that it is a great enemy to the sparrows, killing numbers of them. Its shrill scream quite betokens its fierce character. Like the last-named Falcon it lays four eggs, smaller in size, of a yellow-brown, mottled with a darker shade of the same colour, particularly at the larger end; in length $1\frac{4}{10}$ inch, and nearly $1\frac{4}{10}$ inch in breadth. It breeds during the months of February and March.

FALCO TINNUNCULUS KESTRIL.

I have not been able as yet to discover whether this bird breeds in the Deccan or not.

DESCRIPTION OF A NEW SPECIES OF CYPRIS.

BY W. BAIRD, M.D., F.L.S.

In a collection of shells procured some years ago by the British Museum, from M. Parreyss of Vienna, were two species under the name of *Nuculina*, the *N. donaciformis* and *N. triangularis*. Neither of these, however, belong to the Mollusca, both species being Entomostracans, and belonging to two totally different genera. The former I have described in the 'Annals' for 1850 (vol. vi. p. 89), under the name of *Estheria donaciformis*, the latter is the one now under consideration. It belongs to the genus *Cypris*, and I propose naming it *C. triangularis*. It may be characterized thus:—

CYPRIS TRIANGULARIS.

Shell or carapace of a triangular form, smooth and shining, of a transparent green colour; anterior and posterior extremities nearly of equal size; centre of carapace very gibbous; left valve overlapping the other at the lower margin.

Hab. Abeid, Kordofan. Mus. Brit.

ON A NEW SPECIES OF MUSOPHAGA.

BY JOHN GOULD, F.R.S., V.P.Z.S.

Mr. Gould exhibited a drawing, made by Lieut. J. H. Stack, and some feathers shed from the tail and wings of a species of *Musophaga*, a specimen of which had been living for the last ten years at St. Helena, in the possession of Lady Ross, the widow of the late Sir Patrick Ross, Governor of that island. From an examination of the drawing and feathers above mentioned, Mr. Gould was of opinion that the bird is a larger and more beautifully coloured species than any of the *Musophagæ* with which we were previously acquainted. Lady Ross informed Mr. Gould that it is nearly as large as a common hen-pheasant, and has a long, full, graduated blue tail, which is also the colour of the neck, the whole of the body and the wings, except the primaries, which are arterial blood-red, margined at the tips with a purplish-brown colour, similar to that in *Musophaga violacea*, the bill and the large denuded orbits are yellow, the irides brown; and the crown of the head surmounted with a high rounded crest of hair-like blood-red feathers. It was brought from the western coast of Africa, but the precise locality was unknown.

For this new species Mr. Gould proposed the name of *Musophaga Rossæ*, in honour of its amiable owner. A perfect skin of this bird has since been sent to England, and a full description of it, accompanied by a figure, will be given in the Transactions of the Society.

January 24.—Dr. Gray, Vice-President, in the Chair.

ON THE SIZE OF THE RED CORPUSCLES OF THE BLOOD OF THE GREAT ANTEATER (MYRMECOPHAGA JUBATA).

BY GEORGE GULLIVER, F.R.S.

These have the usual form, but differ in their comparatively large size from those of most other Mammalia. Their average diameter is $\frac{1}{2769}$th of an English inch, varying between the extremes of $\frac{1}{3864}$th and $\frac{1}{2286}$th of an inch.

All observers had come to the conclusion that there is no connection between the size of an animal and that of its blood-corpuscles, when I ascertained that in any truly natural family there is really such connection, however it may be in animals of such different orders as those to which the mouse and horse belong. The Great Anteater has larger blood-corpuscles than any yet examined in the other and smaller Edentata, though they are remarkably large in the Two-toed Sloth; and the Capybara has the largest ever seen among the Rodentia. Indeed, as this last order is characterized by a comparatively large size of blood-corpuscle, it might be supposed that in the great extinct species the corpuscles were larger than any ever measured in the Mammalia; and if any gigantic species allied to the Anteater should be found, its red corpuscles may be expected to be alike remarkable for comparative magnitude.

In the present species they are about the same size as in the Elephant, and are certainly, excepting those of this great pachydermatous animal, the largest yet observed in the Mammalia, as may be seen by reference to the copious Tables of Measurements which I have appended to the English version of Gerber's Anatomy, and to my edition of Hewson's Works, published for the Sydenham Society. With the exception just mentioned, it is still a very interesting fact, that a simple examination of less than one hundredth of a grain of its dried blood would suffice to distinguish the Anteater from any other animal in the Society's Menagerie.

BOTANICAL SOCIETY OF EDINBURGH.

March 8, 1855.—Professor Balfour, President, in the Chair.

The following papers were read:—

1. "A Comparative View of the more important Stages of Development of some of the higher Cryptogamia and the Phanerogamia," by Charles Jenner, Esq.

This paper has appeared in the 'Annals,' p. 211.

2. "Notes of a Botanical Tour in the Channel Islands in August 1854," by Mr. C. Baxter.

The author does not appear to have added to the known flora of the Islands.

3. "On some Gall-like appearances on the Leaves of a species of *Chrysophyllum* from the Rio Negro collected by Mr. Spruce," by Mr. James Hardy.

These productions consist of a considerable number of deep brown, polygonal or suboblong spots, situated near each other on the under surface of the leaf, and occupying slight depressions. They are about 1 line in diameter, only slightly raised above the level of the leaf, and very densely covered with short, closely intertwined, crisp hair. From each of these, when perfect, arises a small subglobular wart, about three-fourths of a line in diameter, of a pale chestnut colour, and densely pubescent, with longer and nearly straight hair. The upper surface of the leaves opposite to these spots is slightly protuberant, and sometimes withered. Occasionally there is a small depression corresponding to the centre of the gall; but this is never pierced. The gall-formed portions are hollow in the centre, and in one of the largest something like the smooth walls of a cell were traced. They appear to have been the habitation of some insect, but are now empty. They have probably not attained their full growth, and this will account for the want of a definite nucleus.

4. "Extracts from a letter from Dr. Cleghorn, on the discovery by Major Cotton of the Gutta Percha plant in Malabar." Communicated by Professor Balfour. In his letter, dated 13th January 1855, Dr. Cleghorn remarks:—"Three days ago Major Frederick Cotton of the Madras Engineers made a discovery. Riding through the Wynaad district a week or two since, he discovered the Gutta Percha tree, and forwarded a specimen of the gum with a branch of the plant to me, from which it appears to be a true *Isonandra*. It is believed that the tree grows abundantly in the jungles of Malabar,

but that is a point which can only be ascertained by diligent search. The importance of the discovery can hardly be over-rated, now that the forests of Singapore have been almost entirely exhausted."

5. "On some Plants which have recently flowered in the Royal Botanic Garden," by Professor Balfour. These plants were *Tricyrtis pilosa*, *Bouceroma Munbyana*—noticed by Munby in his Flora of Algiers, and *Erianthus japonicus*. The last had been sent to the garden under the name of Nepal Sugar-cane. Major Madden writes—"*E. japonicus* occurs all along the Himalaya from Assam up to Simla, growing on the northern sides of the mountains in damp woods, and generally near rivulets, up to 7000 feet, or perhaps 7500, and is a fine species. It has only recently been identified as the Japan plant, and you will find it frequently noted in Griffith's Journals as *Saccharum rubrum*. It has, however, no saccharine qualities, and does not merit the name of Nepal Sugar-cane."

Mr. M'Nab laid before the Meeting a table of observations of the lowest temperatures indicated by the Register Thermometer kept at the Botanic Garden during January and February 1855, from which it appears that the—

Average lowest temperature for January was 31° Fahr.
„ „ for February 23°.

And the average lowest temperature from the 15th January to the 28th February 23°.

MISCELLANEOUS.

ORIGIN OF WHEAT.

The experiments of M. Fabre on the Origin of Wheat, and the consequent conclusions adopted by several distinguished naturalists, that most of our cultivated wheats were derived from species of *Ægilops*, have excited great interest on the continent of Europe. Botanists, whose ideas on the specific distinction of plants marked by slight differences have been carried very far, have felt that their principles would be much shaken if it were admitted that two plants in their opinion so totally different had a common origin, and several refutations of M. Dunal's arguments have been attempted, although hitherto without much success.

M. Godron, of Besançon, one of the authors of the 'Flore de France,' now in course of publication, has just, however, communicated to the 'Annales des Sciences Naturelles,' the result of his observations and experiments, which he considers as removing all weight from the arguments of MM. Fabre and Dunal by accounting otherwise for the phænomena on which they were founded.

The *Ægilops triticoides*, the intermediate form or transitionary state between *Æ. ovata* and wheat, is, according to M. Godron, when growing wild, found on the edges of wheat-fields in a country where *Æ. ovata* is a common weed, and under other circumstances of growth, which suggested to him the idea that it was a natural hybrid between those two plants. He has confirmed this view by actual experiment, fertilizing *Æ. ovata* with the pollen of wheat, and thus producing artificially the *Æ. triticoides*.

M. Godron concludes, therefore, that "the observations made by M. Fabre on the *Æ. triticoides* do not in any manner prove that our cultivated wheat has for its origin the *Æ. ovata*, nor that one species can transform itself into another." Some friends of his in German journals go further, and assert that he has positively disproved M. Dunal's conclusions.

We have nothing to say as to the transformation of one "species" into another, for, according to our notion of the meaning of the word, this circumstance would but prove that the two supposed species were in fact only varieties or races more or less permanent of one species We would, however, make some observations on the remainder of M Godron's paper.

It is admitted that *Triticum sativum* and *Ægilops ovata* are strictly congeners, as confirmed by the form of the caryopsis; that *Æ. triticoides* is the first known instance of a hybrid among grasses, that M. Fabre raised from seeds of a wild *Æ triticoides* plants which produced perfect seed, which he again sowed and continued the operation during twelve successive generations; that during these twelve years' careful cultivation the plants gradually acquired more and more the character of wheat, and that *Æ. triticoides* is occasionally, though rarely, found in sterile places surrounded by vineyards.

But M. Godron observes that there were abundance of wheat-fields in the neighbourhood of the spot where M. Fabre carried on his experiments, from whence the pollen might have been wafted so as to fecundate his plants and produce that gradual assimilation according to the laws of hybrids. So also in the case of the *Æ. triticoides* in the midst of vineyards, there was quite wheat enough cultivated in the surrounding country for some of the pollen to have found its way over to the parent plant of *Æ. ovata*.

Even admitting this extraordinary dispersive power of the pollen of wheat, and that *Æ. triticoides* as now produced is always of hybrid origin, it appears to us that this very great facility of natural hybridization in a family where it is so rare as to have been hitherto unobserved, would appear to prove much rather that the two plants had a common origin, than that they are really distinct species.

Another point much relied on by M. Godron is, that the first start from *Æ. ovata* to *Æ. triticoides* is very great, and that there are no intermediates between two plants so distinct as to be universally admitted as species. That such should be the case with M. Godron's artificial crops would naturally be expected, but that it is so in the wild plant remains to be proved. Most of the supposed species of *Ægilops*, in the South of Europe, are very variable, and run so much one into another, that few botanists can agree as to what are or are not species amongst them.

With regard to the rarity of *Æ. triticoides*, in a wild state, we may observe as a well-known fact, that when aberrant forms of natural species are produced from causes unknown to us, and therefore termed *accidental varieties*, various circumstances tend in a wild state to restrict the number of individuals, or cause the varieties to disappear altogether, whilst they may be rendered permanent by cultivation.

In our opinion, therefore, all that M. Godron has proved is, that *Triticum sativum* and *Ægilops ovata* are species so nearly allied, that they hybridize with a facility very unusual amongst grasses; but we reassert, that this is no proof that the two plants are distinct species.

To this we would add, that neither M. Godron nor M. Alexis Jordan, who has filled 100 pages of the Memoirs of the Academy of Sciences of Lyons with speculations upon the origin of domesticated plants, have attempted to explain what the origin of wheat has been, if it is not a domesticated condition of *Ægilops*, as M. Fabre's experiments, in our opinion, prove it to be.—*From the Gardeners' Chronicle for March* 10, 1855.

Mr. Busk's Anomalous Shell. By Prof. J. S. Henslow.

To the Editors of the Annals of Natural History.

Hitcham, Suffolk, April 17, 1855.

Gentlemen,—I had not seen Dr. Gray's explanation of Mr. Busk's anomalous Oyster-shell till after I had forwarded my notice of the fossil in the Ipswich Museum, which I considered likely to offer a solution of the mystery. I have since been favoured by Mr. Busk with an oyster-shell attached in the way described by Dr. Gray, and I am quite disposed to admit that gentleman's explanation to be the correct one. Dr. Gray has also written to me to say he "described in the 'Philosophical Transactions' for 1833 the fact, that the peculiarities on the surface of a body to which a shell is attached are sometimes shown on the surface of the upper or free valve." The Ipswich specimen is therefore only an additional illustration of a fact long since noticed by my distinguished friend.

Yours faithfully,
J. S. Henslow.

On the Fructification of the Arachis hypogæa.
By Hugh M. Neisler, Columbus, Geo.

In studying our *Stylosanthes* a few years ago, my attention was attracted by a note in Torrey and Gray's Flora of North America, vol. i. p. 354, viz., "Mr. Bentham, in a paper on the affinities of *Arachis*, read before the Linnæan Society in 1838, gives an account of the two kinds of flowers in *Stylosanthes*, and shows its affinity to *Arachis*, which he considers a genuine *Hedysarea*." I presumed that he supposed the *Arachis* to have two kinds of flowers, but, wishing to inform myself accurately as to his views, I mentioned the subject to Dr. Torrey in the course of our correspondence, who remarked in reply: "Mr. Bentham says, that *Arachis* has two kinds of flowers. Those that have all the parts do not perfect their fruit;

the ovary never ripens. The fructiferous flowers have neither calyx, corolla, nor stamens, but consist at first of a minute ovary on a rigid stipe that arises from between two bracteoles. After fecundation, the minute ovary swells, and at the same time burrows in the ground, where it ripens."

On examination, I found in some specimens that had been in flower some days, in the axils of two or three of the lower leaves, minute, sessile (sometimes two or three in a kind of one-sided raceme), conical germs situated between two bracteoles; these gradually elongated themselves, until, reaching the earth, they penetrated beyond the reach of light, where their extremities becoming etiolated they grew succulent, enlarged, and ripened their fruit. The stipe of the fruit varies much in length; in the prostrate forms of the plant from 1 to 3 or 4 inches; but in an upright variety which I cultivate, they grow 6, 12, and sometimes even 18 inches before reaching the earth, and in their growth hang around the stem like aërial rootlets. In the axils next above these fertile germs, in my specimens, I found petal-bearing flowers, which I at first (supposing Mr. Bentham's views of course to be correct) regarded as barren. But after close and repeated examinations, to my surprise I found them in all respects perfect, and what at first sight I had thought a long peduncle which withered with the flower, proved to be a slender, tubular *calyx*, through which there was no difficulty in tracing the style to a minute conical germ, situated between two bracteoles, and in all respects identical with those in the axils below; and after examining a few plants, I succeeded in finding germs elongated to two or three inches, with the marcescent calyx and corolla still *adhering to their points*, and stimulated into growth beyond a doubt by the perfect and fertilized ova. Younger plants just getting into bloom showed petal-bearing flowers in the lowest axils; and doubtless those that I first examined, and which I thought achlamydeous, would have been found so, if seen a little earlier; for, generally, the flower falls away entirely, and is seldom found attached to the germ after withering. *The flowers of the* Arachis hypogæa *are all petal-bearing and all fertile*. The plant is in some respects a singular one, and I am not surprised that Mr. Bentham, or any one else who had not watched it in all stages of its growth, should have fallen into error as regards its fructification.—*Silliman's Journal for March* 1855.

On the Structure of the Starch Granule. By Mr. GRUNDY.

The structure of the starch granule being by no means clearly understood, I am induced to submit the results of a few observations on the subject, with the view, if possible, of adding a little to our knowledge of its structure. There are, as is well known, two views of its constitution; one, especially advocated by Schleiden, considers it as increasing by means of layers deposited from within outwards, and that there is no membrane enveloping the granule; secondly, the view of Nägeli and others that it is a true cell, consisting of a wall and contents, the starch being deposited from without inwards. These two views have been considered completely at variance with each other. I trust, however, to be able to show, that while neither is absolutely false, neither fully accounts for all the phænomena observed in the development of starch. With regard to the first view, the balance of evidence certainly appears in favour of the exogenous, so to speak, development of starch; that is, that the starch is deposited in layers, the inner layers being formed first. As our esteemed President observed at a former Pharmaceutical Meeting, "If you examine the young tuber of the potato, you find only a few fully-formed starch grains, and numbers of small, round, incomplete grains; while in the mature tuber the reverse is the case—the majority of the starch grains are fully formed, and only a few of the small, incomplete grains are met with. If, however, the fully-formed starch be carefully examined, the inner concentric layers are found to be circular, and to present, in fact, precisely the figure and appearance of the small, undeveloped grains, leading thus to the inference that the remainder of the starch has been deposited round these small granules." Now there is no doubt that, as far as it goes, this is a true statement of fact. It appears to me, however, that it does not fully explain all the phænomena. The starch is usually free in the sap, and in those instances in which it is met with adhering to the cell-wall, I think it is only entangled in the mucilaginous protoplasm. Yet we cannot discover any proof, by the use of tests or other means, of the existence of starch, as such, in the cell-sap. Von Mohl supports this conclusion. To me it appears that starch is not at all soluble in water, nor in any state of combination as starch. But instead, we find gum and other matters in the cell-sap, of which starch may be formed, but not starch itself. I think gum, starch and sugar, members of one series, each higher in its state of organization than the other, the crude compounds absorbed by the fibrils of the root being transformed first into gum. If we adopt Schleiden's view, I do not see how we are to account for the deposit of starch. If it be a mere chemical product, it seems singular that it should only be deposited in such definite forms, and never on the cell-walls or on the chlorophyll granules which sometimes occur in the same cell with the starch.

There is, however, the view of its composition advocated by Cruger. He asserts that the primordial utricle is the source of the starch; that the starch granule first appears as a mere point, not coloured blue by iodine; and that, in all stages of the starch granule, a layer of a nitrogenous substance, coloured yellowish by iodine, covers the granule. This layer he looks upon as altered protoplasm, in the course of transition to starch. He obtained plants in which the starch grains were few in number, and in which they were imbedded in the protoplasm lining the cell. I do not see, however, how this view is to be applied in all cases; in the potato, the cells are quite filled with starch—all cannot be imbedded in the protoplasm; besides, protoplasm is nitrogenous, starch is not; protoplasm, therefore, cannot form starch in equal quantity with itself, and there certainly appears more starch in the full-grown potato cell than there ever was of protoplasm. Starch is too, I think, denser than protoplasm, which would tend to increase this difference. My own view on the subject is, that the starch granule is truly a cell, having a wall distinct from the contents. I am inclined to believe that the first formation of starch is by a small portion of the protoplasm becoming aggregated, as a nucleus, developing over itself a membrane; this membrane then commencing to secrete starch around the original nucleus; in fact, that they are produced much as the spores of some Algæ are produced, in which the protoplasm splits into many portions, each secreting itself a cellulose wall. With this addition, I take Schleiden's view of the structure of starch as entirely correct, the only point required being explained by the hypothesis of a membrane, the exact origin of the starch. Indeed, I consider the starch cell as closely analogous to the secreting epithelium cell of animal physiologists—viz. a cell which draws the materials of its growth from the surrounding fluid, and having reached the limit of its growth, dies as a cell, and becomes amenable to chemical influences. The point on which I lay most stress as proof of its cellular character, is the definite size and shape of the granule. If it be formed, as Schleiden asserts, by mere layers of deposit, I see no *à-priori* reason why this process should cease at any particular time, or why the size and shape of the exogenous starch granule should not be as indefinite and unlimited as those of an exogenous tree. A cell, however, has, under the same circumstances, a tolerably definite size and shape. The fully-formed cells of any organ in the same plant agree in the closest manner among themselves as to size and shape, however much they may differ in these respects from the cells of other organs, or from those of the same organ in other plants. This is seen in the clearest manner in undoubted free cells, as spores and pollen grains which in the same plant agree in the closest manner with each other. The cellular character of starch is obscured by the fact that the contents are at all stages solid, so that the use of the compressorium and other means usually employed to determine the cellular character of an object fail from this cause.

Now, if starch be merely a chemical product of the protoplasm, whence does it obtain the distinct definite form so characteristic of this substance? The starch granules of each plant have a certain distinctive form and appearance peculiar to themselves, by which they may be recognized under the microscope, and there are few, if any plants, the starch granules of which are precisely similar in form. Crystallization is the only means by which homogeneous substances, whether organic or inorganic, are aggregated into definite forms. No one, however, would call the starch granule a crystal. Starch, also, does not always occur solitary in cells; it occurs in company with chlorophyll, and possibly raphides. If it were formed by exogenous deposition, it seems to me very probable that occasionally one of these foreign bodies might be entangled and enclosed in the substance of the granule,—not often, perhaps only once in a thousand times, yet, as far as I am aware, no such occurrence has ever been observed.

With regard to the observed existence of a membrane, of which I have not yet spoken, the experiment of Mr. Busk, and also that of merely boiling a little starch in water, and examining the results, are, to my mind, quite conclusive. In the latter case we observe numerous thin, collapsed, vesicular-looking membranes, which do not appear to dissolve after many hours' boiling, while the true starch which these membranes enclose is extracted by the water, as is proved by its behaviour with iodine. This membrane appears to me to differ, not only in consistence, but also in chemical character, from starch, since, if iodine be added to starch which has been boiled in water, and the result examined by the microscope, the blue colour is seen to be due to amorphous masses of starch,—the membranes, when seen separate from the starch, not appearing coloured.

The coloration was produced in some cases by portions of yet adhering starch, which of course was coloured blue. This might, however, be distinguished from a true coloration of the membrane by its patchy granular appearance, and also by the colour not being thicker where wrinkles were visible in the membrane. A large quantity of iodine was required to produce any particular effect; the membranes then became of a deep brownish-red, but not blue, which certainly appears to evidence a different composition from starch. At first I was inclined to believe the enveloping membrane to differ from cellulose, not being able to produce a blue colour with iodine and sulphuric acid. I have since succeeded in producing this effect by macerating boiled starch in dilute nitric acid for several hours. Schleiden has observed that the outer layer of the starch granule behaves differently with iodine from the rest, and explains it by saying that the outer layer becomes infiltrated with foreign matters, which hinder the characteristic reaction of starch This is in all probability correct, but it is inconsistent with his own theory. The outer membrane of the small round granules is affected precisely as that of the larger; yet, according to his views, the small granules were the nuclei, so to speak, on which the larger were to be deposited. Each layer in succession ought to be infiltrated, but evidently is not. His explanation, in fact, is an argument in favour of my view. The membrane, being always exterior, of course runs much greater chance of infiltration. I have not yet said anything of the concentric lines, my theory not being inconsistent with either of the views entertained on the subject. Although I believe in the existence of a membrane, I do not see that the lines must necessarily arise from foldings of that membrane. They may still be due to the existence of layers. Schleiden states that the concentric lines may be traced all round the granule. I have not been able to satisfy myself of this, and am inclined to believe that only the interior lines can be traced entirely round. If starch be heated on a metal plate until it turns brown, then treated with weak solution of iodine and examined, crescentically-shaped pieces appear to separate from the large end of the granule, leaving a central rounded portion, while the smaller end is not so visibly affected. Of course, according to Schleiden's view, the continuity of the lines is a necessary consequence of the formation by layers. I did not attempt to trace the continuity of each line: I endeavoured to count the number from the small end to the hilum, and from thence to the large end, and could always distinguish more lines in the latter direction. The starch certainly appears, when heated on a metal plate, to separate in the direction of the concentric lines. Also, if starch be made into a paste with gum, and thin slices be taken from the mass, many sections of the granules will be made. As far as my observations extend, if a granule from which only a small piece has been cut off be observed, cross lines upon the cut surface uniting the concentric lines will be seen. If, however, the section extend through the middle of a granule, such lines will not be observed. Also in examining uninjured starch, I fancy that, the starch (being beyond the focus) as it is brought into focus, the concentric lines come into view on the surface of the granule before the edges are quite brought into focus, as though the markings were superficial. May not the lines be formed by foldings of the membrane dipping into the starch, and disposing it to break up in the direction of the folds, somewhat analogous, in fact, to the ruminated albumen of the nutmeg? I do not positively assert this view, but merely throw it out as a conjecture; it seems to me not improbable. The hilum I believe to be the remains of the nucleus, which in full-grown vegetable cells is generally absorbed; that it is a hollow space filled possibly with amorphous starch, perhaps only with water or cell-sap. I think, however, that the only method of attaining a sure knowledge of the structure of the starch grain is by observations on its development; by taking, for instance a potato, examining by sections the first appearance of the tubers when they appear as mere swellings of a fibril, and continuing the observation up to the cells of the fully-formed tuber. I purpose making some observations on the subject during the spring, and if I find them of any value, will communicate them to the Society.—*From the Pharmaceutical Journal*, April 1855.

Description of a New Species of Aulacorhamphus.

By John Gould, F.R.S.

AULACORHAMPHUS CÆRULEOGULARIS.

Upper surface dark green, with an olive tint on the head and nape, and of a brighter green on the rump and upper tail-coverts, primaries blackish brown, margined externally at the base with dark green; tail deep green, passing into blue towards the extremity, and tipped with rich chestnut; throat and fore part of the cheeks cærulean blue; under surface green, washed with yellow on the flanks and abdomen; under tail-coverts rich chestnut; bill black, with the exception of the upper part of the sides of the upper mandible and the apical portion of the culmen, which are greenish yelllow, passing into purer yellow at the tip; on the sides of both mandibles at the base a broad band, which on the upper one is yellow, and on the lower white; orbits red; legs and feet greenish lead-colour.

Total length, 12¼ inches; bill, 2⅞; wing, 4½; tail, 4¾; tarsi, 1¼
Hab. Veragua

Remark.—Nearly allied to *Aulacorhamphus albivitta*; but distinguished from that species by its rich blue throat, by the band at the base of the bill being much broader and yellow on the upper mandible, instead of white, and by the under surface being washed with yellow, while in the other it is pure green.—*From the Proc. Zool. Soc.* Feb 22, 1853.

METEOROLOGICAL OBSERVATIONS FOR MARCH 1855.

Chiswick.—March 1. Heavy rain. very fine halo round the moon in the evening 2 Cloudy. rain. 3 Low white clouds heavy rain clear and fine. 4. Clear. cloudy and fine. 5 Slight fog very fine 6 Cloudy and fine foggy. 7. Frosty· fine. 8. Very clear fine sharp frost 9 Frosty few snow-flakes overcast. 10 Snowing sharp frost at night 11. Cloudy rain at night 12. Cloudy: rain. 13. Fine. 14 Fine. cloudy. 15 Cloudy· rain. 16. Densely overcast fine. 17 Fine rain clear. 18. Cloudy and boisterous. 19. Showery. 20. Foggy very fine. 21. Cloudy and cold hail-shower 22 Sleet. cold rain overcast boisterous 23, 24. Cloudy and cold. 25. Fine: sharp frost at night. 26. Clear cloudy fine 27 Very fine. 28 Drizzly heavy rain. 29. Cloudy clear and fine. 30. Cloudy 31. Heavy clouds· clear and fine.

Mean temperature of the month	37°·61
Mean temperature of March 1854	42 ·54
Mean temperature of March for the last twenty-nine years...	42 ·21
Average amount of rain in March	1 33 inch.

Boston.—March 1. Fine. rain P M. 2. Fine. 3. Fine. stormy and rain A M. 4, 5 Fine. 6, 7 Foggy 8 Fine 9. Cloudy. 10 Fine. 11. Fine. snow P.M. 12 Cloudy rain P.M. 13 Rain: rain A M. 14 Cloudy. 15 Fine. 16 Fine rain A.M. 17. Cloudy rain A M and P M. 18, 19. Fine. 20, 21 Cloudy. 22 Cloudy· snow A.M. 23—25. Cloudy. 26. Fine. 27, 28. Cloudy. 29—31. Fine

Sandwick Manse, Orkney—March 1. Showers A M and P.M. 2 Rain A M. and P.M. 3 Rain A M drizzle P.M. 4 Clear A.M cloudy, large solar halo P M. 5. Clear A M. cloudy P.M. 6. Bright A.M.. clear, fine P.M. 7, 8. Bright, hoar-frost A.M: clear, frost P.M. 9. Bright, hoar-frost A M.. clear, drops P M. 10. Snow-showers A.M. cloudy P M. 11. Cloudy A.M · snow-showers P M. 12. Snow-showers A.M.. snow-drift P M. 13. Snow A.M.. cloudy P M. 14 Bright A M. clear, aurora P.M. 15 Bright A.M. cloudy P.M 16. Rain A.M. cloudy P M. 17 Clear A M. · damp P.M 18. Rain A M. showers, aurora P M. 19 Bright A M.: clear, aurora P.M. 20. Bright A.M.: clear P.M. 21 Clear A.M.. clear, aurora P.M. 22—24. Snow-showers A.M.: clear P M. 25. Snow-showers A.M. and P.M 26 Snow A.M. clear, frost P.M. 27. Snow, clear A M. cloudy P.M. 28. Cloudy A.M.: clear P M. 29, 30. Clear A.M. and P.M. 31 Bright A.M. clear P.M.

Mean temperature of March for twenty-eight previous years	40° 53
Mean temperature of this month	36 ·61
Mean temperature of March 1854	45 ·14
Average quantity of rain in March for fourteen previous years	2·52 inches.

The mean temperature of this month is lower than that of March during any of the twenty-eight years of my observations, except in 1837, when it was 36°·51, and in 1839, when it was 36°·33. That of March last year was the highest during the whole period.

Meteorological Observations made by Mr. Thompson *at the Garden of the Horticultural Society at* CHISWICK, *near London*; *by* Mr. Veall, *at* BOSTON; *and by the* Rev. C. Clouston, *at Sandwick Manse*, ORKNEY.

Days of Month	Barometer.					Thermometer					Wind			Rain.		
	Chiswick.		Boston, 8¾ a.m.	Orkney, Sandwick		Chiswick		Boston 8¾ a.m.	Orkney, Sandwick		Chiswick 1 p.m.	Boston.	Orkney, Sandwick.	Chiswick.	Boston.	Orkney, Sandwick.
1855 March	Max.	Min		9¼ a.m	8¾ p.m.	Max	Min		9¼ a.m.	8¾ p.m						
1.	29·625	29·527	29·20	28·88	28·97	53	39	37	38	40	sw.	ssw.	w.	·09	·21	·20
2.	29·355	29·001	28·95	28·77	28·71	53	38	42·5	38	38½	sw.	sw.	se.	·23	·06	·28
○ 3.	29·434	28·898	28·42	28·59	28·74	50	30	42·5	40	40	sw.	ssw.	wnw.	·06	...	·23
4.	29·576	29·573	29·26	29·24	29·36	49	27	34	39½	37	sw	sw.	e.	...	·05	·16
5.	29·793	29·730	29·40	29·25	29·46	53	26	36	40½	40½	se.	ssw	w.	...	...	·02
6.	29·866	29·851	29·58	29·78	29·88	51	23	33	41	34	ne	calm	calm	...	...	...
7.	29·892	29·816	29·58	29·94	30·11	46	22	31·5	38	32	e.	ne.	ne.	...	...	...
8.	30·086	30·066	29·80	30·15	30·05	45	18	34	34	33½	ne	n	se.	...	...	·02
9.	30·063	29·894	29·77	29·86	29·79	41	27	34	36	36½	e	e.	sse.	...	...	...
10.	29·838	29·754	29·58	29·65	29·58	40	17	32	37	36	se	ne.	sse.	...	...	·44
☾ 11.	29·673	29·374	29·43	29·40	28·96	37	29	27·5	36	32	w.	se.	sse.	·33	...	...
12.	29·018	28·886	28·62	28·76	29·00	46	31	34	34½	31½	sw	sw	ese.	·24	·35	·62
13.	29·522	29·206	28·87	29·20	29·42	49	29	37	34	34	sw	w.	ese.	...	·25	·06
14.	29·634	29·594	29·34	29·50	29·68	45	31	36	36½	31	s.	s.	ne.	·01	...	·02
15.	29·793	29·522	29·50	29·66	29·40	46	39	33	36½	36½	se.	sse	sse.	·21	...	...
16.	29·707	29·518	29·17	29·26	29·24	53	32	39	35	36½	w	sw	sse.	...	·25	·40
17.	29·641	29·498	29·25	29·34	29·22	50	33	45	40½	37	sw.	s.	ene.	·09	...	·24
● 18.	29·730	29·667	29·25	29·21	29·58	48	34	42	38	37	w.	w	nnw.	·02	·15	·16
19.	29·922	29·877	29·59	29·80	29·89	55	30	36·5	36	33½	sw.	w.	n	·01	...	·11
20.	29·824	29·735	29·50	29·89	29·83	58	37	42	36	33	se.	ne.	calm	...	...	...
21.	29·391	29·107	29·20	29·66	29·60	45	34	38	38½	32½	ne	ne.	ne	·02	...	...
22.	28·908	28·882	28·77	29·60	29·58	36	33	34	35	32	ne	ene.	calm	·13	...	·10
23.	29·180	29·025	28·85	29·37	29·32	38	27	32	38	33	n.	n.	n	...	·03	·04
24.	29·301	29·283	29·08	29·35	29·40	38	25	34	36½	34½	nw.	ne.	nnw	...	...	·09
☽ 25.	29·621	29·402	29·22	29·45	29·48	43	18	35·5	35½	35	ne.	n	w.	...	...	·05
26.	29·662	29·645	29·40	29·55	29·70	45	29	31	34½	32½	ne.	n	nw.	...	...	·29
27.	29·821	29·786	29·50	29·86	30·04	51	27	37·5	37½	36	s	nw.	nw.	...	...	·02
28.	30·230	30·029	29·75	30·11	30·26	41	31	37·5	40	41	e.	...	w.	·29	...	...
29.	30·434	30·420	30·13	30·40	30·45	44	25	38·5	46	40½	ne.	n.	calm	·02	...	...
30.	30·438	30·418	30·13	30·43	30·39	46	29	39	43	35½	ne.	n.	se.	...	...	·03
31.	30·408	30·375	30·10	30·37	30·32	45	22	40	40½	37½	ne.	n.	sse	...	...	...
Mean.	29·722	29·589	29·36	29·557	29·593	46·45	28·77	36·2	37·74	35·48				1·75	1·35	3·58

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XXXV.—*Monograph on the British Species of* Phalangidæ *or Harvest-men.* By R. H. Meade, F.R.C.S.

[With two Plates.]

THE Harvest-men have never excited much interest among British naturalists, few even being aware of the existence among us of more than three or four species; and this neglect is the more surprising, as from the considerable size possessed by most of them, the facilities for determining their characters are much greater than among many other minute animals which have received far more attention.

A desire to supply this omission has induced me to make the present attempt to arrange and describe all the British species that I have been able to obtain, and in doing so I shall endeavour to give the synonyms of other authors, as far as I can determine them with certainty; comparing in every instance the specimen with their descriptions and figures, and citing no work which I have not been able to examine.

On the continent, this family of Arachnidans has excited much more interest than in England. In France, Latreille published a memoir on them in 1802, in the same volume with his 'Histoire Naturelle des Fourmis.' In this he briefly described ten species as natives of France, but his specific characters are short and imperfect, so that it is difficult to identify some of them; and he fell into the error of confounding together two or three of the most common species. Latreille's memoir was read at the Institute in 1796 (though not published until 1802), and he must be considered as the first author who endeavoured to revise the Linnæan genus *Phalangium*. In 1798 and 1799, Herbst published in Germany an elaborate monograph on this tribe, which is contained in the second and third parts of the work entitled 'Natursystem der ungeflügelten Insekten,' by Lichtenstein and Herbst. Twenty-three species are here described, and most of them are also figured, but the descriptions and figures are not sufficiently accurate to be of much value. Herbst rejected the name of *Phalangium*, which he applied to the animals now placed in the genera *Phrynus* and *Telyphonus*, and adopted the title of *Opilio* in a generic sense, still keeping all the species of this family in one genus.

Soon after the appearance of the works of Latreille and Herbst, another was written on the same subject by Dr. J. F. Hermann; it is named 'Mémoire Aptérologique,' and was edited by Professor Hammer of Strasburg, where it was published in 1804 after the death of the author. It was accompanied by coloured plates which are very imperfect, but the descriptions of some of the species are tolerably good. Hermann retained the name of *Phalangium*. In his highly classical 'Genera Crustaceorum et Insectorum,' Latreille gave much more exact descriptions of some of the more common species of Harvest-men, but he perpetuated the error into which he had fallen, of confounding together the two distinct species *Phalangium cornutum*, and *Ph. opilio*, of Linnæus, describing them as being only the male and female of the same species After the appearance of this work in 1806, nothing seems to have been added to our knowledge of the European Phalangidæ until the publication of the works of Walckenaer in France and Koch in Germany. In the third volume of the 'Histoire Naturelle des Insectes Aptères' (which appeared in 1844) by the former author, the Phalangidæ are described by M. Paul Gervais, who appears to have been satisfied with copying the descriptions of the French species from Latreille's first work, and I should think had never examined any of them himself, as he has fallen into all his errors. His synonyms are often very incorrect.

The works of Koch occupy a very different position to the one just mentioned. The great work, 'Die Arachniden,' by this author (which was commenced by Hahn), contains many beautiful figures of these animals, and full and accurate descriptions of most of the European species. Koch, after the example of Herbst, rejects the name of *Phalangium* for the Harvest-men. He calls the family Opilionidæ, and subdivides it into many new genera; naming the one which contains the greatest number of species, *Opilio*.

Having thus briefly mentioned the principal works which have appeared on this subject, I must say a few words on the external form and structure, as well as the habits and manners, of these singular animals, before I begin the description of the genera and species: I shall not enter however at any length into the anatomy of the Phalangidæ, but must refer any of my readers who are anxious to obtain more information on this head, to an elaborate paper by Mr. Alfred Tulk on the "Anatomy of *Phalangium Opilio*," published in 1843 in the 12th volume of the 'Annals and Magazine of Natural History'

The Phalangidæ, which belong to the Tracheary division of the Arachnidæ, bear a considerable external resemblance to true Spiders, but differ in having much longer and more slender legs, in the abdomen being sessile or attached to the whole breadth of the cephalothorax, and destitute of spinnerets at its extremity, in having only two eyes, which are elevated on a common peduncle; and in having the mandibles or falces furnished with didactyle forceps.

The dermo-skeleton consists as in the Spiders solely of tough integument, but differs in being divided into rings or segments, generally very distinct on the abdomen, and marked with transverse rows of small projecting cells, tubercles, or ocelli. The body is of an oval or rounded shape and somewhat depressed. The cephalothorax and abdomen appear at first sight to be composed of a single piece, there being little or no constriction between them; but when closely examined, a strongly marked groove or ridge will mostly be seen separating the first ring of the abdomen from the plate or buckler covering the upper surface of the cephalothorax The species are mostly of a sombre colour, varying from black or gray to brown and yellow The upper surface of the abdomen is mostly marked by a wide longitudinal dorsal band (*vitta*) of a darker colour than the rest of the back, differing in shape in different species, but generally wavy or dentated at the edges. This band often extends forwards to the cephalothorax, sometimes it is indistinctly seen, but some traces of it may almost always be distinguished The cephalothorax, which constitutes about a third or fourth of the length of the body (being proportionally much larger in the males than the females), is trapezoid in form, being narrower in front, where it is generally excavated or concave, and having the sides prolonged backwards and outwards. The lateral edges are surrounded by a sinuous or wavy border, on which, opposite the attachment of the first pair of legs, are seated two stigmata or spiracula, which were clearly described by Latreille, but have since been sometimes mistaken for cornea or simple eyes. The eyes, two in number, are large and simple, and seated upon an eminence or elevation placed nearly in the centre of the cephalothorax; one eye being placed laterally upon each side of the eminence, which is mostly semicircular in shape, and surrounded by a double crown or crest, which is armed with tubercles or spines. The upper surface of the cephalothorax is also often furnished with sharp teeth or tubercles; the size and arrangement of which, as well as the size and form of the eye-eminence, form good generic and specific characters.

The falces each consist of two joints. The basal joint projects forwards and arises from the cephalothorax within a cavity situated beneath the anterior border of the plate. The terminal joint is bent downwards, and terminates in a curved, horny, immoveable pincer, which is opposed and articulated to another pincer (by some reckoned as a third joint) similarly constructed, but freely moveable. Both pincers are furnished with teeth upon their inner edges. In the males of several species the falces are provided with horns, or processes of various forms and sizes.

The parts composing the mouth are very complicated; the oral aperture is surrounded by three pairs of lateral bodies which are called maxillæ, and is bounded below by a membranous lip. There are two long palpi consisting each of five divisions; the intermediate joints are sometimes furnished with processes or branches, and the last is armed with a claw. They are connected with the first pair of maxillary bodies. Savigny says*, "On examining the palpi of the Harvest-men and other Arachnidans, and comparing them with the legs properly so called, we soon have many proofs that they are themselves only anterior legs more or less altered. The connexion between them is so close, that in the *Phalangia* the four long anterior legs have their first joint converted into a supplementary maxilla: in fact the *Phalangium* has six maxillæ, of which two only support palpi and four others true legs." He adds further on, "It appears to me certain that the Arachnida possess neither true mandibles nor true maxillæ."

The variations of form in the maxillæ are of no value among the Phalangidæ, in affording generic or specific characters, as with the true Spiders.

The legs, remarkably long and slender in most species, are eight in number, and consist of numerous joints; the first is named the coxa, and is immoveably fixed to the under part and side of the cephalothorax; the second is called the trochanter, it is very short and of a roundish or square form; this is connected with the former by a ball and socket joint, allowing of free motion in every direction. The third joint is generally very long, and frequently rugose and spiny, it is named the femur. The fourth and fifth are called the first and second joints of the tibia, which is said to be divided; the first of these is much shorter than the second, and neither of them equals the femur in length. The remaining part of the leg is denominated the tarsus, and divided into numerous joints, the number of which varies in different species; the proximal joint is much longer than the succeeding ones, and is called by Koch* the heel, this is generally more or less distinctly subdivided into other joints, which seem however to be immoveable. Koch considers the variations in number of the subjoints of the heel and of the joints of the tarsus as forming valuable generic characters, but they appear to me to be too artificial, and will be found too difficult of application to be of much practical value.

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* Mémoire sur les Anim. sans Vertèbres, p. 57.

The last subject to be mentioned in this sketch of the external anatomy of the Phalangidæ is the situation of the generative organs. In this point the Harvest-men differ remarkably from the true Spiders, for in the latter the males may at once be distinguished from the females by the peculiar position of these organs at the extremity of the palpi, while in the Phalangidæ they are placed in the same situation in both sexes, and present no external points of difference, so that it sometimes becomes very difficult (particularly in immature specimens) to distinguish the males from the females.

On the fore part of the under surface of the abdomen, immediately behind the parts composing the mouth, and extending as far forwards as the coxæ of the third pair of legs, an obtusely triangular body is placed, which is called the sternum by Mr. Tulk. This is the covering of the sheath of the sexual organs, the orifice leading to which is concealed beneath a thickened lip on its anterior border. If the sides of the front part of the abdomen are gently pressed by the finger and thumb in living adult specimens, the penis of the male, or the ovipositor of the female, may easily be made to protrude (an observation originally made by Lister), and thus the sexes may be distinguished. The male organ is a long slender curved body furnished at its extremity with a recurved hook, while the ovipositor is an elongated membranous tube surrounded by annuli or rings, which give it much the appearance of the trachea or windpipe of a small animal.

With regard to the habits of the Phalangidæ very little is known. Their long legs enable them to run with great rapidity, particularly over grass and bushes, and Latreille says that they also act as feelers, for while resting upon a wall or tree, they are usually extended round the body in a circular manner at their full length, and if one of them is touched by any dangerous object, the Harvest-man immediately drops to the ground and runs off. The legs show great nervous irritability, for when any of them are detached, they preserve an independent power of motion for some time. Geoffroy thought that these animals possessed the same power as the Spiders and Crustacea, of reproducing lost limbs; for he once met with an individual that had one leg much shorter than the others. No decisive experiments have been made on this subject, and Latreille thinks it very unlikely that they should have this faculty; for they are much shorter-lived than either Spiders or the higher Crustaceans, their term of existence being limited to the summer and autumn months. The female, whose abdomen in the autumn will be found filled with round white eggs, deposits these beneath stones, or in crevices of walls and in other secure places, and then dies; these eggs are hatched in the following spring or summer, when minute individuals, very similar in form and shape to the adult animals, may be found beneath stones or at the roots of grass. These increase in size during the summer, but do not arrive at maturity until the autumn, when the sexes pair; and as soon as cold weather sets in they all quickly disappear. No observations have been made as to whether the Harvest-men cast their integument and undergo periodical moultings, as in the true Spiders; and I have found it difficult to keep them alive in captivity so as to make experiments on this and other points in their œconomy. They are usually nocturnal in their habits, generally remaining concealed (or at rest on walls) during the day, and feed upon insects and other small animals. I captured however an adult female of *Phalangium urnigerum* in August 1854, while running across a path in a wood in the daytime with a fly (*Anthomyia*) in its falces as large as the common house-fly, which it was very unwilling to relinquish. Latreille says that they are very voracious and will destroy one another.

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* Uebersicht des Arachnidensystems, 2 Heft, p. 22.

The Harvest-men are frequently infested by a bright red parasitic mite, which may very often be seen attached to their bodies or legs; it is named the *Trombidium phalangii**. This mite is only parasitic during its immature or larva state, when it is hexapod, of an oval shape, and has the head terminating in a projecting conical beak or sucker, by which it adheres to the skin of the *Phalangium*. Dugès has observed that they are ultimately detached from the Harvest-men, and secrete themselves in minute crevices in the earth, where they remain for the space of twenty days in the form of a smooth oval chrysalis like a small yellow egg, out of which there emerges the perfect mite, which has eight legs, is of an obtuse triangular shape, very pubescent, and of a bright scarlet colour, but having the head and legs yellow and semitransparent.

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* See Walck. Hist. Nat. des Ins. Apt. tom. iii. p. 180; and Latreille's Genera, tom. i. p. 161, where it is called *Leptus phalangii*.

In conclusion, I beg to offer my acknowledgements to all those friends who have kindly collected and forwarded specimens of Phalangiidæ for my inspection. My thanks are especially due to Mr. Blackwall, Mr. Francis Walker, and Dr. Sichel of Paris. The last-named gentleman sent me numerous interesting French specimens belonging to the different orders of Arachnida, which have been very useful to me in the determination of British species.

I propose to arrange the species of Phalangiidæ in six genera, adopting the following classification :—

Class ARACHNIDA.

Order **Phalangidea.**

Family PHALANGIIDÆ

Genus 1. *Phalangium*, Linn.

Legs long and thin, the second pair being five or six times the length of the body. Body oblong-oval, convex. Cephalothorax studded with tubercles, which are often furnished with short spines. Eye-eminence moderate in size, and surmounted by a double crest formed by tubercles or teeth. Abdomen generally marked by an angular dorsal band. Palpi moderate in length except in the males of some species, the second and third joints often with projecting angles, but not branched.

1 *Phalangium cornutum*, Linn. Pl. X. fig. 1.

Fœm. testacea. Dorsum abdominis vitta fusca marginibus angulatis signatum. Dentes duo minuti et porrecti, subter marginem anticum thoracis positi. Cristæ oculariæ conspicuæ et spinosæ. Oculi sursum distantes.

Mas, palpis longissimis, et falcibus superne longe cornutis. Long. fœm. 4, maris 2½ lin.

Phalangium cornutum, Linn Syst Nat by Turton, vol iii. p 716 ♂; Herm Mem. Apt. p. 102. pl 8. f. 6; Walck Ins. Apt. t. iii. p. 118; Hahn, Die Arach B. ii. p. 69.

Phalangium Opilio ♀, ***cornutum*** ♂, Latr Hist. Nat des Fourm p. 377; Latr. Genera, t. i. p 138.

Opilio cornutus, Herbst, Ung. Ins. Heft ii. p 13 pl. 1. f 3.

Cerastoma cornutum, Koch, Die Arach B xvi. p. 8. tab. 543.

Female. Lurid or testaceous. Body oval. Cephalothorax small, considerably narrower than the abdomen, and furnished at the sides with an irregular margin, which is armed at the edges with several sharp tubercles, and separated by a deepish groove from the rest of the cephalothorax. In this groove are seated three oblong dark spots placed opposite the bases of the three first pairs of legs. The front edge of the cephalothorax is rather short and slightly excavated; its lateral angles project forwards between the bases of the first pair of legs and the falces, and there is a slight central projection, immediately beneath which are seated two small prominent teeth. The ocular eminence is of moderate size; the crests are rather widely separated by a groove, and each furnished with six or seven sharp teeth (fig. 1 *a*). In front of the eyes the cephalothorax is elevated, the central part smooth, and marked by two longitudinal dark parallel lines; several sharp tubercles armed with short black spines are arranged on each side of this smooth space, and a few others are scattered on the sides of the cephalothorax. The colour of the cephalothorax is yellowish-white, and there are several large irregular brown marks on each side. The eye-eminence is ferruginous.

The cephalothorax is separated from the abdomen by a groove, between which and the eye-eminence is a transverse row of small tubercles. The first two or three abdominal rings are distinctly marked, and also crossed by transverse rows of minute but sharp tubercles.

A broad longitudinal dentated dark band extends from the margin of the ring immediately behind the eye-eminence to the apex of the abdomen. The edges of this band for a short distance are straight; they then curve alternately inwards and outwards, forming two triangular projections on each side, the posterior of which is smaller and often indistinct. The band is often edged externally with white, and in many specimens is altogether indistinct. The sides of the abdomen are irregularly marked with brown. The whole under surface of the body is white.

The *falces* are strong; the basal joint is mottled above with brown, and furnished with a patch of small spines; the terminal joint forms rather an acute angle at the point of curvature, and is also furnished on its front surface with dark bristles.

The *palpi* are rather short; the third joint is thickened at its distal extremity, where it has a projecting angle on the inner side; they are marked with brown stripes on their upper surface.

The *legs* are long and slender; the femora quadrangular, the angles being armed with short dark spines; the distal ends of the femora are marked with a few brown spots; both joints of the tibiæ are also spotted with brown; the extremities of the tarsi are black.

The *male* is smaller than the female, but has the cephalothorax proportionably larger, forming about two-fifths of the length of the body; the abdomen is depressed; the colour both of the body and legs darker, and the dorsal mark less distinct; the thorax is more spiny, and has the anterior angles strongly toothed and projecting; the falces are very large (fig. 1 *b*), the first joint strong, tuberculated and spiny on the upper surface; the second joint bears a large ascending horn, the apex of which is more or less bent forwards. The palpi are very long, being about one-third shorter than the first pair of legs; the second joint, which is much the longest, is of a dark brown colour and spiny. The legs are very long, of a dark colour, and have the femora very spiny. In young males, the horns on the falces, and the palpi are much shorter than in the adult individuals.

This common species is generally distributed I have entered at considerable length into the description of the female in consequence of so many errors having been fallen into respecting it; by most writers this sex has been either unknown or confounded with *P. parietinum* (*opilio*, Linn.). see further remarks at the end of the description of that species.

2. *Phalangium urnigerum*, Herm. Pl. X. fig. 2.

Fœm. lutea vel cretacea, vitta angulata dorsali, et lateribus fuscis; thorax annulis abnormibus et obscuris; palpi articulis 3^{tii} et 4^{tis} brevibus et crassis.

Mas, vitta dorsali lata et fere nigra, thoracem et frequenter abdominem obducente; dorsum tuberculis minutis albidis granulatum; pedes longissimi nigro irrorati.

Long. fœm. 3 ad 4, maris 2 ad 3 lin.

Phalangium urnigerum ♂, Herm. Mem. Apt. p. 110. pl. 9. f. 2, 3.
Opilio lucorum ♀, Koch, Die Arach. B. iii. p. 30. pl. 84.
Opilio albescens ♀, Koch, Die Arach. B. xvi. p. 33. pl. 551.
Opilio grossipes ♂, Koch, Die Arach. B. xvi. p. 23. pl. 548.

The *female* bears a considerable resemblance in size, colour and design to that of *P. cornutum*, and no doubt has generally been confounded with it: it differs however from the preceding species in having the front of the cephalothorax wider and straighter, in the absence of teeth beneath the middle of the anterior border, in the eye-eminence being smaller and narrower (fig. 2 *a*, *b*), the crests on its summit divided by a shallower groove, and furnished with shorter and blunter teeth. The upper surface of the thorax is provided with several white bluntish tubercles or papillæ, which are irregularly scattered over it, the greater number however being collected in somewhat of a semicircle (the concavity of which is forwards) between the eye-eminence and the anterior border. The sides and front of the thorax are variegated with several irregular brown ring-shaped marks. The dorsal band, which is of a brown or blackish and sometimes reddish colour, generally with a light streak down the centre and dark margins, extends from the lateral edges of the thorax, opposite the insertion of the second pair of legs, even to the last ring of the abdomen. The band is wide in front, and gradually contracts in breadth to a point opposite the attachment of the fourth pair of legs; behind this it bends alternately outwards and inwards, forming two or three triangular projections on each side, and terminates in an indistinct rounded point at the extremity of the abdomen. The under surface of the body is whitish.

The *falces* are strong (fig. 2 *d*), the second joint forming a less acute angle at its point of curvature than in *P. cornutum.*

The *palpi* are rather longer and stronger than in the preceding species; the second joint with a slightly projecting angle at its inner extremity covered with a tuft of hair; the third and fourth joints short and thick, and as well as the second, variegated with black or brown marks.

The *legs* are long and striped with brown or black; the distal extremities of femora and tibiæ armed with short spines.

The *male* (fig. 2 *c*) resembles the female in structure, but is smaller and shorter, and is generally so much darker in colour, that it has been mistaken by all authors for a distinct species.

The *falces* and *palpi* are of the same form as in the female, but the legs are much longer.

The *palpi* and *legs* in adult individuals are often almost black; the upper surface of the cephalothorax and abdomen is also frequently of the same colour, including the eye-eminence, and it then has a pretty appearance from being studded with little pearl-like white papillæ or tubercles, arranged in transverse rows across the abdomen, and scattered irregularly over the thorax. The under surface and sides of the body are pure white.

This species is generally distributed over England, frequenting woody and grassy places, where the females may be found in various stages of growth during the whole summer, secreted beneath stones. The males are not met with until the beginning of autumn. The female of this species was first described by Koch under the name of *O. lucorum*; his *O. albescens* is also only a variety of the same species.

The male is separately described and figured by him under the name of *O. grossipes*, the title of a species described by Herbst; the figure and description given however by the latter author are too vague for identification, therefore I have adopted the name of *urnigerum*, under which the male was clearly described in the posthumous work of Hermann, by the editor Professor Hammer.

3. *Phalangium parietinum*, DeGeer. Pl. X. fig. 3.

Fœm. cinerea, subtus albida; dorsum fuscus transversis semilunaribus nigris, et punctis pallidis variegatum; eminentia oculorum parva; pedes fusco- et albo-annulati.
Long. 4 lin.

Mas, testaceus, concoloratus, pedes longissimi immaculati.
Long. 3 lin.

Phalangium Opilio, Linn Syst Nat Turton's edit. vol. iii p. 716.
Phalangium parietinum, Herm Mem. Apt p 98
Opilio parietinus, Herbst, Ung. Ins Heft 2 p 12 ♀, Koch, Die Arach. B xvi p 12 tab 545
Opilio longipes, ibid p 22. tab 2. fig 2 ♂

Female Body elongated oval. Abdomen slightly contracted immediately behind its junction with the cephalothorax. The latter small and narrow in front, where it is rather deeply notched, the notch however being divided by a central projection. Eye-eminence small, longer than high (fig. 3 *a*), oval when seen sideways, narrow above, the crests on its summit being near together, these are each furnished with five or six small blunt teeth. Between the eye-eminence and the anterior margin of the thorax are two elevated ridges, each armed with a row of three or four rather large teeth, enclosing a smooth narrow space between them. Several other sharp tubercles or teeth are scattered along the lateral parts of the thorax. *Colour* of the cephalothorax yellowish-gray, mottled with white. Abdomen ash- or fawn-coloured, without a distinct dorsal band, though the central part of the back is darker than the rest. Upper surface variegated with dark semilunar transverse marks and small whitish spots. Under surface of the body white, marked with brown or black. *Palpi* small, joints without projecting angles *Falces* weak. *Legs* long, slender, and nearly smooth; femora of second pair longer and thinner than the rest; coxæ and trochanters spotted with black, the other joints annulated with brown and white rings.

Male. Body short and broad Abdomen small and depressed. Cephalothorax largely developed, being nearly as long as the abdomen, rugose, and having the tubercles and teeth on its surface much larger and more numerous than in the female. Cephalothorax separated from the abdomen by two strongly marked rings or ridges. *Palpi* and *falces* stronger than in the female; *legs* very long, and armed with short black spines or bristles.

Body and limbs all of a yellowish-brown colour, the under surface of the body, palpi, falces, and bases of the legs being paler than the rest.

This species, which is found very commonly upon walls in the autumn, is the true *Phalangium opilio* of Linnæus. I have however adopted the specific name of *parietinum*, first given by DeGeer, in consequence of using the word *Opilio* in a generic sense, in imitation of Herbst, Koch, and Leach. *P. parietinum* does not appear to have been known at all to Latreille, he confounded the female of *P. cornutum* with it, and finding the males and females of the latter in union, jumped to the conclusion that the *P. cornutum* and *P. opilio* of Linnæus were only the male and female of the same species. Most authors have fallen into the same or into equally great errors, and until the publication of Koch's figures and descriptions in 1847, the greatest confusion existed respecting these two common species. As noticed by Mr. Tulk, they are mostly found in different localities; the *cornutum* living in rural or suburban situations, beneath stones, or among dry herbage, while the *parietinum* is seldom seen except upon the walls of buildings.

4. *Phalangium canescens*, Koch.

Fœm. cana. Vitta angulata dorsalis cinerea, linea centrali pallida et punctis albidis instructa. Palpi 3^{tiis} articulis valde angulatis.
Long. 2 lin.

Opilio canescens, Koch, Die Arach. B. xvi. p. 28 pl. 549 f 1522

In general form and design this small species bears considerable resemblance to the female of *P. cornutum*; it differs from it however in not being above half the size, and in having the surface of the cephalothorax, as well as the falces and legs, nearly free from tubercles and spines. The sides of the cephalothorax are rather elevated. The eye-eminence is nearly semicircular, of a moderate size, and furnished with a small but sharp crest.

The colour is whitish-gray, with a dark angular dorsal band, which is sprinkled with white spots, and intersected with a longitudinal central white streak. The *palpi* are moderately long, and the third joint has a strongly projecting internal angle; they are of a whitish colour, striped above with brown; they are also covered with thinly scattered black hairs, and have dark extremities. The *legs* are rather short, of a yellowish colour, slightly marked with brown, and have the extremities of the tarsi dark.

The *male* is unknown.

This species is generally distributed, but not very common.

5. *Phalangium minutum*, n. s.

Canum vel murinum, nigro variegatum, vitta dorsali lata et angulata signatum. Eminentia ocularia ampla, tuberculis obtusis cristata.
Long. $\frac{2}{3}$ lin.

Body rather short and wide; cephalothorax large, with a considerable-sized eye-eminence, crested with bluntish tubercles.

The colour is whitish or yellowish gray. The front and sides of the thorax are variegated with a few irregular-shaped black spots, and the back of the abdomen is traversed longitudinally with a widish dorsal band having one triangular projection on each side. It is of a dark gray colour, mottled or variegated in a transverse direction with white. The palpi are furnished with a projecting process on the third joint, and together with the legs, which are rather short and stout, are of a yellow or brownish colour.

I have seen but two specimens of this very minute *Phalangium*, one of which was immature. I was doubtful about the sex in both of them, and their habitat was unknown to me.

Genus 2. *Megabunus**, mihi.

Eye-eminence very large, furnished with a projecting double crest and large eyes. Palpi branched, and spiny on the under surface. Legs of moderate length and slender. Body rather short, and cephalothorax large in both sexes.

1. *Megabunus corniger*, Herm. Pl. X. fig. 4.

Testaceus vel luteus, vitta dorsali, et lateribus abdominis ferrugineis.
Mas, falcium articulo secundo, ante apicem chelas prope, in cornu superne elevato.
Long. fœm. 3, maris 2 lin.

Phalangium cornigerum, Herm. Mem. Apt. p. 102. pl. 8. f. 2; Walck. Hist. Nat. des Ins. Apt. t. iii. p. 119.
Opilio corniger, Koch, Die Arach. B. iii. p. 87. pl. 102.

Cephalothorax nearly as wide as the abdomen. *Eye-eminence* large and broad (fig. 4 *a*); the crests separated by a deepish groove, and each armed with seven or eight large but bluntish tubercles (*b*). Eyes large, and surrounded by black rings. Colour of the cephalothorax pale brownish-yellow, marked with irregular brown spots. *Abdomen* convex, oval, and rather pointed at the apex, similar in colour to the cephalothorax, having a ferruginous dorsal band (often indistinct), which is wider in the centre than at the extremities, and separated by a pale line from the sides of the abdomen, which are of a dark colour. Under surface of the body pale. *Falces* rather long, and pale in colour except at the points of the forceps, which are black. *Palpi* rather long, the two first joints covered beneath with long teeth and bristles (fig 4 *d*); the second joint is thickened at its extremity; the third is furnished at the end with a projecting branch on its inner side, the fourth has a similar but smaller projection. All the joints are covered with fine hairs, and are of a pale yellowish colour, except the extremity of the terminal joint, which, together with the hook at the end, is black. *Legs* of moderate length, slender, and of a yellowish colour; femora with short black spines.

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* From μέγας, great, and βουνός, eminence.

Male very similar to the female in structure and colour, but the abdomen is shorter and the legs are longer. The *falces* are furnished with a short conical sharp horn (fig *c*), which projects from the front and outer surface of the second joint, just above the forceps.

This distinct and pretty species occurs in woods in different parts of England, but does not appear to be very common.

2. *Megabunus insignis*, n. s. Pl. X. fig. 5.

Cinereus nigro variegatus, eminentia oculifera, pedibus et palpis testaceis. Cristæ ocularíæ spinis longissimis instructæ. Margines thoracis, et femorum tibiarumque articulorum apices, dentati.

Long. fœm. 2, maris 1 lin.

Body oblong and convex. *Cephalothorax* large and angular. *Abdomen* compressed at the sides and pointed behind. Each side of the cephalothorax is armed with two spines, and there is sometimes a small one projecting from the centre of the anterior margin. Eye-eminence very large (fig. 5 *a* & *b*), and slightly contracted at the root into a thick pedicle. Eyes very large and surrounded by a black circle. The crests (separated by a wide interval) are each formed by five large tubercles, which are armed with long dark spines. The ground colour of both the cephalothorax and abdomen is pale blue-gray, and they are each spotted and marbled with black. The sides of the abdomen are marked with large black patches, and there is a broad longitudinal dorsal band of an angular or rhomboidal shape, the margins of which are black and the centre dark gray. The *palpi* are stout, the second joint is long and curved, and has a small projecting process furnished with a tuft of hairs at its distal extremity on the inner side. The under surfaces of both the first and second joints are armed with long teeth. The third and fourth joints are branched; the under surface of the latter is also provided with two or three teeth, and the ends of both the branches and the terminal joints of the palpi are covered with dark hair. The *legs* (which together with the palpi and eye-eminence are testaceous in colour) are annulated with pale rings. The apices of the femora and first joints of the tibiæ are each armed with one or two sharp and long spines (fig. *c*). The coxæ of the first pair of legs are armed on the under surface with numerous teeth.

The *male* is similar in form and colour to the female, but is much smaller, it has the eye-eminence proportionably larger and the spines on the legs longer.

This very remarkable-looking animal, which, with its large spiny head and great eyes, presents a very grotesque and even (through the microscope) formidable appearance, is not figured or described in any work that I have seen, which leads me to the belief that it is perhaps peculiar to Great Britain. It is generally distributed, but not common in this country. I have twice found it in the neighbourhood of Bradford; I have also received specimens from Mr. Blackwall, collected in North Wales, and have likewise obtained it from other parts of England, and from Ireland.

Genus 3. *Opilio*, Herbst.

Legs of moderate length, the second pair, which is always the longest, not generally being more than four times the length of the body, and in the females often less, the first joints of the tarsi (*heels*) undivided. Body somewhat depressed: cephalothorax with three projecting teeth on its upper and front surface, and with the lateral margins often crenulated or toothed. Eye-eminence small, and with a toothed crest. Palpi of moderate length, the third and fourth joints often with projecting processes or angles; the first and second joints are always armed with numerous large and strong spines on the under surface; coxæ and trochanters also spiny; dorsal band when present generally oblong and square at the extremity. Edges of the abdominal rings often fringed with sharp tubercles or spines.

1. *Opilio histrix*, Latr. Pl. XI. fig. 6.

Corpore cinerascente, vel testaceo, quadrato-ovali et depresso; thoracis lateribus valde crenatis, et spinis tribus robustis, approximatis et porrectis, marginis antici medio positis; tuberculo oculifero granulis obsolete coronato; abdomine vitta dorsali nigricante, quadrata; pedibus crassis et brevibus.

Long. fœm. 4 ad 5, maris 3 lin.

Phalangium histrix, Latr. Hist. Nat. des Fourm. p. 376; Gen t. i. p. 140; Walck Hist. Nat. des Ins. Apt. t iii. p. 121.
Opilio histrix, Leach, Samouelle's Ent. Comp. p 120

Cephalothorax nearly semicircular, and considerably narrower than the abdomen, which is depressed; the front is elevated and bears a cluster of tubercles, the three foremost of which are prolonged forwards in the form of large thick teeth (fig. 6 *c*). The circumference of the cephalothorax is armed with teeth, which are arranged on crenulations or semicircular projections, three or four in number on each side. Eye-eminence small and crested, with blunted tubercles (fig. 6 *a*). Abdomen with the posterior edge of each ring furnished with a row of minute teeth. Legs short and stout, first joints of the tibiæ armed with short spines at their extremity (fig. 6 *b*).

The colour is dirty yellow, spotted and mottled with brown; there is an oblong dorsal band on the abdomen with nearly straight sides and square extremity, of a brown colour, the margins of which are darker than the centre. The abdominal segments are marked by transverse rows of round yellow spots, each having a dark point in the centre. The legs are pale yellow annulated with brown. The male is shorter and proportionably wider than the female, but otherwise similar.

I have included this fine *Phalangium* in the list of British species upon the authority of Samouelle, who says, in his 'Entomologist's Useful Compendium,' that it is found in England, but I have never seen a native specimen. It is very common in the neighbourhood of Paris, from whence I have received many individuals. In the illustrated edition of the 'Règne Animal,' published by the pupils of Cuvier in 1840 (the division on the Arachnida in which was edited by Dugès and Milne-Edwards), there is an imperfect representation of this species, marked fig. 1 *a* in plate 23, where it is designated as the female of *P. cornutum*, and named *P. opilio*. This gross inaccuracy proves that there is as much ignorance respecting the species of this family in France as in England.

2. *Opilio ephippiatus*, Koch.

Corpore ferrugineo vel murino, albo punctato; vitta dorsali nigra vel ferruginea, maribus valde notata; lateribus abdominis argenteis: thorace tribus dentibus gracilibus et fere erectis, margine antico, medio positis: pedibus gracilibus.
Long. fœm. 3, maris 2 lin.

Acantholophus ephippiatus, Koch, Die Arach. B xv. p. 121. t. 539.

Body somewhat short and convex; abdomen rather wider than the cephalothorax and pointed behind; anterior margin of the cephalothorax almost straight, and having an eminence in the centre of its upper surface upon which are seated five or six sharp teeth; three of these, which are nearly equal in size and longer than the others, are placed close together in a parallel row in front and project nearly perpendicularly upwards; behind these are seated two or three others. On each lateral angle of the front margin is placed another tooth, forming the inner boundary of the spiracle, which is also bounded externally by one or two more teeth. Between the attachments of the second and third pair of legs is a small semicircular projection or crenulation of the lateral edge of the cephalothorax, on which are seated three short spines or rather pointed tubercles. Another similar but smaller toothed projection is seated behind this, between the insertions of the third and fourth pairs of legs. The eye-eminence is small, and narrow at its upper part; the crests, which are each furnished with four or five sharp tubercles, being approximated together, so as to leave a very narrow groove between them; by this means the eyes, which are large, and surrounded with a black ring, are made to look somewhat upwards. The falces and palpi are rather small and weak. The legs are slender.

The colour is reddish brown or gray, darker in mature specimens, and often variegated with white and black spots and silvery reflections. The dorsal band extends through the cephalothorax (the posterior part of which it covers) to the commencement of the posterior third of the abdomen; the thoracic portion is triangular and broad, and at the base of the abdomen it contracts into a straight longitudinal band with nearly parallel sides and square extremity. The colour of the band is reddish brown or black; the margins are darker than the centre, and it is surrounded by a pale streak. The sides of the abdomen are mottled with white, and have a metallic silvery lustre. The legs are annulated with brown, and a wide piceous band surrounds the extremity of the second joint of the tibiæ.

The male closely resembles the female, but is smaller and darker in colour, and is more distinctly marked, having the dorsal band darker and narrower. The legs are longer.

This species bears considerable affinity to the former one (*O. histrix*), but is much smaller, has the legs longer and more slender, and the teeth on the anterior part of the cephalothorax placed in a more upright position. It is found abundantly in various parts of England and Wales, at the roots of grass, in meadows and pastures, at the latter end of summer. This is included with several other Phalangiidæ in Koch's genus *Acantholophus*, the characters of which are much the same as those I have assigned to the genus *Opilio*; I have adopted the latter name however in consequence of its having been applied by Dr. Leach to the species *histrix*, which may be considered as the typical one; and also because the title *Acantholophus** is not characteristic of the genus, the ocular crest being only furnished in most species with short spines, and not by any means conspicuous.

3. *Opilio agrestis*, n. s.

Corpore murino, fusco et albo variegato; vitta dorsali indistincta: dentibus frontalibus brevibus et crassis: eminentia oculifera fere lævi: pedibus fusco annulatis.

Long. 2 lin.

This species closely resembles *Opilio ephippiatus* in general form; it is however rather smaller, and has three much shorter and thicker teeth on the front of the cephalothorax, the middle one of which is longer than the others. The lateral margins are free from crenulations, but each has two short stout teeth, one placed between the first and second, and the other between the second and third pairs of legs. The eye-eminence is almost devoid of tubercles or teeth on the crest.

The colour of this species is darker than that of *O. ephippiatus*; the dorsal band is distinctly marked on the cephalothorax, but becomes indistinct upon the abdomen, which is marked by transverse rows of dark brown stripes intermingled with white spots. The legs are short and feeble, and annulated with blackish-brown marks.

The male is similar to the female, but has the body smaller and darker, and the legs longer.

This is a very common species, and is met with in the same localities as the preceding.

4. *Opilio terricola*, Koch.

Corpore luteo, rubro alboque punctato; vitta dorsali tenuiter notata; eminentia oculifera dentibus longis cristata; palporum articulis tertiis quartisque digitatis.

Long. 1½ lin.

Opilio terricola, Koch, Die Arach. B. iii. p. 48. t. 90. f. 204.

Body rather short; cephalothorax equal in width with the abdomen, the back of which is a little elevated; front margin of cephalothorax straight and rather wide; three long and slender teeth project forwards and a little upwards from its centre, the middle tooth being considerably longer than the others; the external angles, where the spiracles are seated, are also furnished

* From ἄκανθα, a thorn, and λόφος, a crest.

with short spines. The ocular crests are each armed with four long blunt teeth, the two middle or upper of which are longer than the others, and the second from the front the longest of all. The palpi are of moderate length; the second joint is spinous on its under surface, and the third and fourth are furnished with projecting hairy processes at their extremities; the fourth has also two or three teeth on its under surface. The legs are short, particularly the first and third pairs, which are much abbreviated, particularly the former; the second pair is much longer than the others.

The predominating colour of this species is dull pale yellow, which is mottled or variegated with white and reddish brown. The spiracles on the external angles of the cephalothorax are surrounded by a dark or black spot; there is no distinct dorsal band, but two rows of reddish-brown spots extend across the thorax and abdomen, enclosing a longitudinal space between them, which is wide and triangular on the thorax, becomes contracted at the base of the abdomen, and then dilates posteriorly into an oval form. The legs and palpi are faintly annulated with pale reddish-brown marks.

The sexes of this pretty and well-marked little species are not known; the only specimen that I have seen, and which appeared to be a male, was transmitted to me by Mr. Blackwall, and captured by that eminent arachnologist in North Wales.

Genus 4. *Leiobunus*, Koch.

Legs particularly long and slender. Body rather short and round, especially in the males; cephalothorax without tubercles or spines; eye-eminence small and quite smooth, being destitute of crest; palpi rather short and slender, and without projecting processes or angles.

1. *Leiobunus rotundus*, Latr. Pl. XI. fig. 7.

Fœm. corpore pallido-testaceo; in dorso abdominis macula fusca quadrata, pallide punctata; cephalothorace fronte et lateribus fusco; corneis, nigrocinctis; pedibus tenuibus et longissimis, fuscis.

Long. 2½ ad 3 lin.

Mas, corpore brevi et orbiculato-ovali, ferrugineo vel testaceo, unicolorato.

Long. 1½ ad 2 lin.

Phalangium rotundum, Latr. Hist. Nat. des Fourm. p. 379; Genera, t. i. p. 139; Walck. Ins. Apt. t. iii. p 119.
Phalangium rufum, Herm. Mem. Apt. p 109. pl. 8. f. 1.
Phalangium longipes, Hahn, Die Arach. B. ii. p. 70. pl. 71. f. 162.

Opilio fasciatus, Herbst, Ung. Ins. part 2. p. 23. pl. 4. f. 1, 2 ♀.
Opilio hemisphæricus, ibid. part 3 p. 11. pl. 9. f. 2 ♂.
Leiobunum rotundum, Koch, Uebers. des Arachnidensystems, ii. p. 36.
Leiobunum hemisphæricum, Koch, Die Arach. xvi. p. 51. pl. 556, 557.

The body of the *female* is convex and of an oblong oval shape. The margins of the cephalothorax are angular, but as well as the surface devoid of tubercles or spines; beneath the front margin over the base of the falces are two blunt projecting processes. The eye-eminence is small and smooth (fig. 7 *b*). The colour is testaceous, very pale in young specimens, and becoming darker with age; the front and sides of the cephalothorax, the apex of the abdomen, and an oblong quadrate spot on the dorsum of the latter are dark brown; the dorsal spot or band is spotted with yellow. A brown or black circle surrounds the eyes. The legs are dark brown in mature specimens, with the ends of the femora and tibiæ mostly white; when young the legs are pale. The palpi are tinged with brown on the upper surface.

The *male* differs from the female in being much smaller; in having the body short and round (fig. 7 *a*) (whence the name of the species); in being darker in colour (ferruginous when adult); in being devoid of dorsal band, and other dark marks on cephalothorax or abdomen. The legs are also much longer and darker in colour; the second pair of legs is twelve and a half times the length of the body.

This species is very abundant in woody places, where it may almost always be seen in the summer, running rapidly over the leaves and long grass: it is very frequently infested with the parasitical red mite.

Genus 5. *Nemastoma*, Koch.

Body short and ovate; cephalothorax and abdomen without any distinct line of separation; eyes seated either upon an irregular eminence near the anterior border of the cephalothorax, or upon elevated scale-like projections. Body distinctly annulated; rings separated by an interval at the apex of the abdomen. Palpi long and filiform. Falces horned in the males.

1. *Nemastoma bimaculatum*, Fabr.

Atrum, maculis duabus oblongis, albidis, ad basin abdominis. Long. 1 lin.

Phalangium bimaculatum, Latr. Hist. Nat. des Fourm. p. 376; Herm. Mem. Apt. p. 105 pl. 8. f. 4; Walck. Ins. Apt. t. iii. p. 119
Opilio bimaculatus, Herbst, ii. p. 25. tab. 3. f. 3, 4.
Nemastoma bimaculatum, Koch, Die Arach. B. iii. p. 71. tab. 96. f. 223.

Body convex and ovate, narrower in front than behind; the upper surface of the cephalothorax and base of the abdomen are covered with a hard granulated membrane, which on the latter is elevated into distinct projecting rings or segments. Eyes seated on a broad and slightly elevated eminence, placed close to the anterior margin of the cephalothorax; the eminence is rough and irregularly tuberculated on the summit, but has no distinct crest; there is a deep notch in the centre of the front border of the cephalothorax. The palpi are nearly as long as the body and filiform; the first joint is short, the second is the longest, the others gradually diminish in length. The legs are short and rather thick; the first pair is not more than twice the length of the body, and the second (the longest) not more than three times. The coxæ are tuberculated on their under surface.

The whole body is black or brown, with the exception of two white or sometimes yellow spots, of an oblong form, which are seated on each side of the upper surface of the body, a short distance behind the eye-eminence. The palpi and legs are also black or brown; the bases of the femora are encircled by two narrow pale rings.

The males are similar in form and colour to the females, but are smaller, and have a thick blunt horn or process projecting from the end of the first joint of the falces forwards over the second joint. This is a very common species in England, and may frequently be found under stones.

2. *Nemastoma chrysomelas*, Herm. Pl. XI. fig. 8.

Luteum; medio thoracis, dorsoque abdominis brunneis; hoc duobus ordinibus punctarum argentearum, illo lateribus argenteis; oculis super squamas positis; palpis longissimis et pubescentibus; femoribus quasi mediis articulatis.

Mas, falcibus bicorniculatis.

Long. fem. 1, maris ⅔ lin.

Phalangium chrysomelas, Herm. p. 108. pl. 8. fig. 3.
Nemastoma chrysomelas, Koch, Uebersicht, Heft 2. p. 38.

Body ovate; the front of the cephalothorax truncate; eyes seated at the inner extremities of two large triangular scale-like processes (fig. 8 *b*), which extend from the sides towards the front and centre of the cephalothorax, where they become elevated, and have their apices serrated or dentated, thus forming a double crest above the eyes; the anterior and posterior margins of the scales are also serrated. The back of the abdomen is covered with transverse scaly rings, the edges of which are notched and projecting; towards the apex the rings are separated by considerable intervals.

The palpi are slender, and about one and a half times the length of the body; the second and third joints are longer than the others, and nearly equal to each other in length.

The legs are rather longer than in the preceding species, and slender; the apices of the two tibial joints are thickened.

The colour is dull white or yellow; the apices of the thoracic scales are dark brown or black; the dorsum of the abdomen is brown; the spaces between the posterior rings are pale. Two rows of silvery, and sometimes golden spots, are arranged longitudinally on each side of the dorsum, the spots being seated on the rings; they become more distinct towards the apex; the sides of the cephalothorax are also adorned during life with silvery or golden reflections. The falces, palpi and legs are brown; the basal joints of the palpi and the extremities of the femora and tibiæ are pale; the middle of the femoral joints is annulated with several pale rings, giving them the appearance of being divided into numerous articulations.

The males have both joints of the falces armed with short, thick, horny processes (fig. 8 *e*); but resemble the females in shape and colour, with the exception of being about a third smaller, and rather darker.

This very elegant little species is not common; but I have found several specimens in the neighbourhood of Bradford, beneath stones, in the autumn, in woody places. Hermann, the only author by whom it has been described (Koch only alluding to his account of it), says that it is found in forests, among moss.

Genus 6. *Homalenotus*, Koch.

Body depressed and flat on the upper surface. Cephalothorax narrow and pointed in front, without stigmata on the margins, and distinctly separated from the abdomen. Eye-eminence small and tuberculated, but without a regular crest. Abdominal segments distinct on the under surface, but soldered into a uniform plate or buckler on the dorsum, which is furnished with several rows of large blunt tubercles. Legs short and spiny, the second pair slender, the others thickened; the first joints of the tarsi undivided.

Homalenotus quadridentatus, Fabr. Pl. XI. fig. 9.

Ochraceus; abdomine tuberculorum pallidorum serie quadruplici ornato (ordinibus duobus centralibus, super maculas fuscas positis); apice quadridentato. Cephalothorace frontis medio cornu porrecto.

Long. 8 lin.

Phalangium spinosum, Latr. Hist. des Fourm. p. 375.
Phalangium quadridentatum, Latr. Gen. tom. i. p. 140; Walck. Ins. Apt. tom. iii. p. 120.
Homalenotus monoceros? Koch, Die Arach. B. xv. p. 188. pl. 534. f. 1493.

Cephalothorax narrow; the front part is somewhat semicircular, and the front margin projects into a central point, which is elevated and prolonged into a horn-like process, about half the length of the thorax, and projecting upwards and forwards. This horn is double at the base, the lower portion forming a kind of spur, about half the length of the upper one, and placed vertically beneath it, so as not to be visible when the animal is examined from above. The sides of the thorax are straight, and the posterior angles project backwards. The eye-eminence is small, rather higher in front than behind, and surmounted by several blunt tubercles. The whole upper surface of the thorax, as well as the abdomen, is scabrous, but destitute of spines or bristles: behind the eye-eminence, and close to the posterior margin of the thorax, are two blunt tubercles.

The abdomen is wide and flat; the apex is wide and rather elevated, and furnished with four large, blunt, but short teeth, which project beyond the margin, and are placed rather wide apart from each other, at equal distances. Four longitudinal rows of tubercles extend down the back, the two central rows being nearer to each other than to the lateral ones, which approach the sides. Each row contains four tubercles, which are much larger in the middle than in the lateral rows; in the latter they are small, and sometimes indistinct.

The falces are small and weak. The palpi are short, with the third and fourth joints rather thickened. The first and third pairs of legs are very short, the length of the femora not being more than twice as much as the width. The second pair is rather longer than the fourth, and more slender than any of the rest. The coxæ, trochanters and femora are all furnished with long blunt teeth; those on the coxæ projecting round the margin of the thorax, and looking as if attached to it.

The colour of this species is brownish yellow, mottled and striped with dark brown; a double brown line encircles the thorax, intersected with cross bars; there is a dark mark on each side of the eye-eminence, and the tubercles on the posterior margin of the thorax are seated on dark spots, as are also those on the abdomen. All the tubercles are pale yellow. Four dark stripes extend from the tubercles at the apex of the abdomen towards the dorsum. The legs are annulated with brown in adult specimens.

This peculiar *Phalangium*, which differs considerably in its structure from any other known species, bears considerable resemblance to the animals composing the genus *Trogulus*. The only locality in which I have found it was on the chalk hills near Hampden, in Buckinghamshire, where it was tolerably abundant among moss in August 1854. It is probably not uncommon in the south of England.

EXPLANATION OF PLATES X. AND XI.

PLATE X.

Fig. 1. *Phalangium cornutum*, body of the female: *a*, side view of the cephalothorax; *b*, part of the cephalothorax and one of the falces of the male.

Fig. 2. *Phalangium urnigerum*, body of the female: *a*, side view of the cephalothorax; *b*, side view of the body with the falces and palpi; *c*, body of the male; *d*, one of the falces.

Fig. 3. *Phalangium parietinum*, body of the female: *a*, side view of the cephalothorax.

Fig. 4. *Megabunus corniger*, body of the male: *a*, eye-eminence seen from above; *b*, side view of the same; *c*, one of the falces of the male, *d*, palpi of male and female.

Fig. 5. *Megabunus insignis*, body of the female: *a*, side view of the eye-eminence; *b*, the same seen from above; *c*, one of the legs; *d*, side view of the body.

PLATE XI.

Fig. 6. *Opilio histrix*, body of the female: *a*, side view of the eye-eminence; *b*, one of the legs; *c*, frontal teeth.

Fig. 7. *Leiobunus rotundus*, body of the female: *a*, body of the male, with one of the palpi attached; *b*, side view of the eye-eminence; *c*, one of the legs; *d*, one of the palpi.

Fig. 8. *Nemastoma chrysomelas*, body of the female: *a*, side view of the body in the male, showing one of the palpi and falces; *b*, eye-eminence or scale; *c*, apex of the abdomen; *d*, one of the falces in the female; *e*, the same in the male.

Fig. 9. *Homalenotus quadridentatus*, the body with legs and palpus attached on one side.

XXXVI.—*On the Structure of Chlorophyll.*

By HUGO VON MOHL.

[Concluded from p. 329.]

WITH the pellicular form of the chlorophyll, such as occurs in *Zygnema* (and in still more intimately connected layers in *Draparnaldia, Ulothrix*, &c.), as a more or less perfect investment of the cell-wall, is connected in many respects the chlorophyll of *Anthoceros*, for this, in like manner, does not possess the form of isolated grains, but presents itself in every cell as a single chlorophyll-mass, which in a portion of the cells has a membranous form. But the chlorophyll of *Anthoceros* is distinguished from that of *Zygnema*, by the fact that in the latter genus it stands in no direct connexion with the central nucleus, and forms a peripherical layer, while in *Anthoceros* the green colouring matter is connected with one of the masses of protoplasm enveloping the nucleus, and, at least in a portion of the cells, occupies a central position.

In all the cells of the frond of *Anthoceros lævis* (with the exception of the epidermal cells), we find a large globular parietal nucleus, within which lie a considerable number (perhaps 100 and more) of small, longish starch-grains. This nucleus is enveloped in a mass of protoplasm, which runs out into two or more short, thick, radiating processes applying themselves to the cell-wall, or has the form of a disk irregularly dentate at the circumference, and corresponds to the lines of circulating protoplasm which in other cells run out from a mass enveloping the nucleus. This entire mass is of a bright green colour, and constitutes the only mass of chlorophyll occurring in the cell.

In the epidermal cells the form of the chlorophyll-mass is somewhat more complicated. Taken as a whole, it has the form of a thin disk stretching across the cell, parallel to the outer wall of the latter, containing in its centre a large globular nucleus, within which lie numerous starch-granules. In young cells, situated near the point of vegetation of the frond, this disk stretches entirely across the cavity of the cell, and its borders are applied upon the side-walls, so that the cell when seen from above appears entirely green. But in the full-grown cell the margin of this green disk has separated at from four to six places from the wall of the cell, become retracted and at the same time turned up towards the outer wall of the cell; so that the disk has now assumed the form of a star-shaped membrane, with from four to six broad rays separated from each other by roundish sinuses, and excavated into the form of gutters on the upper side; the nucleus lies in the centre of this membrane, projecting strongly into the interior of the cell.

It is evident that in this plant the mass of protoplasm, which envelopes the nucleus in all plants, acquires a special development, and that the green colouring matter is connected with it. Whether or not the latter permeates the substance of the nucleus I was unable to discover. The protoplasmic mass appeared finely granular; there was no internal movement of its mass corresponding to the rotation of the sap of many cells. There were no starch-grains in the protoplasm, but only in the nucleus. The presence of these starch-granules, and particularly their large number, is a peculiarity of *Anthoceros*, which is also met with in those nuclei which have no chlorophyll in their vicinity, as, for example, in the epidermal cells of the capsule.

The alterations undergone by the chlorophyll of *Anthoceros* through the action of water, correspond entirely to those above described of *Zygnema*. The chlorophyll-mass swells, with a shortening of its radiating processes, into an irregular globular or ovate shape, the starch-granules lying in the nucleus become at the same time more distinctly visible, while in the interior are formed one, or more rarely two large vesicles, which break through the outer green layer. Sometimes the formation of a single large vesicle is replaced, in a larger or smaller part of the grain, by that of a large number of small vacuoles, so that the substance of the grain is converted into a frothy mass. No trace of an outer membrane can be detected, consequently I cannot regard as appropriate Hofmeister's application of the term chlorophyll-utricle to this peculiar structure (Vergleich. Untersuch. höh. Kryptog. p. 3).

Notwithstanding, therefore, that the anatomical conditions of the chlorophyll of *Anthoceros* differ essentially from those existing in *Zygnema*, the green-coloured masses of the two plants correspond exactly in regard to the character of their substance and their reaction with water. Hence it seems to follow that all that is requisite for the formation of chlorophyll is, that the green colouring matter be formed in a cell and enter into combination with a mass of proteine substance, be the latter what it may; in any case it is evident that there does not exist any definite elementary organ, comparable in its organization to the cell, uniformly distributed throughout all plants possessing chlorophyll, and especially charged with the formation of this substance. The agreement in the properties of the green-coloured substance of two structures so different as the chlorophyll-masses of *Zygnema* and *Anthoceros*, leads readily to the conjecture that these properties, the different behaviour of the outer green, and internal substance to water, depend less upon peculiarities in the organization (for, as above remarked, no trace of definite structure is visible), than upon the deposition of the green colouring matter, of resinous character and combined with wax. The hypothesis is not far-fetched, that we must regard the different behaviour of the outer and inner substance of the chlorophyll-mass, the greater consistence of the former and the violent expansion of the latter in water, as simple consequences of the proteine substance being permeated principally or solely in its outer layers by these foreign substances, insoluble in water;—or, at least, that this difference, if dependent upon an unequal consistence of the different layers of the proteinous foundation of the chlorophyll-mass, is essentially heightened by that circumstance.

If we turn to the usual form in which chlorophyll occurs, to that of isolated grains, we find that the position of the latter in the cells is not always the same. They are never found swimming freely in the cell-sap, but always stand in connexion with the protoplasm contained in the cell. In the great majority of cases they are applied upon the cell-wall; under these circumstances, we may detect by careful observation, if not in all, yet in most cases, that the globules are imbedded in a mucilaginous, transparent mass, by which they are attached to the internal surface of the primordial utricle, or with which, in particular cases, as in *Vallisneria**, they are carried along in a flowing movement. In most cases no definite relation can be detected between these parietal chlorophyll-globules and the nucleus and the currents of protoplasm issuing from it; in other instances, on the contrary, the connexion is very manifest. For example, in the parenchyma-cells of the stem of the *Selaginellæ*, the chlorophyll-grains lie in moniliform rows in the protoplasm-threads, which creep out over the cell-wall from the parietal nucleus; and in the Potato, if allowed to become green in the light, chlorophyll-grains are formed in the accumulation of protoplasm surrounding the nucleus, and in the threads radiating from this, in the cells devoid of starch-grains which lie beneath the corky layer.

In regard to the structure of the chlorophyll-globules, investigation of a large number of plants enables us to distinguish two varieties, which in their extreme forms exhibit important differences, not however sharply defined, but passing into one another by a multitude of intermediate stages.

One form consists of globular, but ordinarily flattened grains, with one of their flat sides attached to the cell-wall, the diameter not often exceeding $\frac{1}{300}$ to $\frac{1}{250}$ of a line, frequently not attaining this magnitude. When crowded together, their circumference assumes, like that of epidermal cells, a six-sided, but not acute-angled form, as this form is undoubtedly the result of mutual pressure, this existing notwithstanding that the grains are not in immediate contact, it may be fairly concluded, that they are imbedded in a mucilaginous layer not always recognizable by the microscope, the mutual pressure being communicated through this mucilage. We may distinguish in their substance, frequently however not until after the action of water, fine globules attaining a diameter of about $\frac{1}{2000}$ of a line, which sometimes project upon the surface of the grain, so that its circumference is not bounded by a uniformly curved line, but appears irregularly toothed.

Water very quickly exerts a considerable influence upon these globules. As soon as it penetrates through an opening into the cavity of the cell, the globules swell into vesicles, their green colour becoming much lighter and the granules lying inside becoming more distinct. When there are many globules in a cell, and hence the vesicles which they form come to press upon each other, in most cases (at least before the application of iodine) all distinct appearance of detail is lost, and the green contents of the cell seem to have become fused together into an amorphous mass; a condition undoubtedly often seen in microscopic investigations, but which has mostly been regarded as a mechanical disturbance of the chlorophyll resulting from pressure with the knife, or as a proof of the existence of amorphous chlorophyll. But when the globules lie at greater distances apart in the cell, or emerge singly into the water, one is enabled to trace more accurately the alterations they undergo from the action of water. These are essentially of the same kind as those above described of the chlorophyll of *Zygnema* and *Anthoceros*. In each grain one or more vacuoles are formed, expanding the green substance, and afterwards breaking through it in the form of colourless vesicles. The green substance sometimes retains its cohesion, and remains hanging as a cup-like cover upon one side of the vesicle, sometimes becomes partially disintegrated, so that separate pieces of it, distinguishable by their colour or their granules, remain attached, isolated, upon the outer surface of the vesicle; whereby it is clearly perceived that the mucilaginous substance in which the vacuole lies, bears the green substance on its surface, and does not form a membrane surrounding the green matter. The substance of these chlorophyll-globules is very soft, so that not unfrequently, when the covering-glass is placed upon the object, some of the globules which have escaped into the water adhere to the glass and become pushed up together into a shapeless mass, which then usually assumes a frothy condition through the formation of many small vacuoles. That the outermost layer of these chlorophyll-globules possesses a firmer consistence is in the highest degree probable, since otherwise a similar adherence of the globules to foreign substances would be more common, and the mutual pressure would unite the globules into a common mass; but no trace can be discovered of a true membrane distinct from the internal substance. In my former treatise, I stated it to be probable that the fine granules lying in the chlorophyll, in which, from their minute size, I could not discover whether or not they were coloured blue by iodine (as is the case with the larger granules of the second form), were in like manner starch-grains; this was an error, as the use of better microscopes has now convinced me; these revealing that the granules are coloured brown by iodine, in which they agree with the granules occurring in the protoplasm,

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* I may take this opportunity of adding, that in the cells which form the partitions of the air-cavities in the leaves of *Ceratophyllum demersum*, the chlorophyll-granules exhibit a motion like that in *Vallisneria*, but so slow, that in two cases in which I measured it carefully, they only advanced $\frac{1}{21,660}$ and $\frac{1}{24,000}$ of a line in a second [This circulation may be well seen in the same manner in the cells of the leaves of *Anacharis Alsinastrum*, but it appears to vary much in rapidity according to circumstances.—A. H.]

I may name *Clivia nobilis*, as a plant in the leaves of which this form of chlorophyll-globules is very beautifully developed, and which is therefore exceedingly well-suited for investigation.

The chlorophyll-globules of the second kind are frequently larger than those above described; their diameter amounts, for example in the leaf of *Ceratophyllum demersum*, to $\frac{1}{120}$ of a line. In their interior may be perceived, even in the fresh globules, more distinctly however after the action of water, and still more clearly by the blue colour produced by iodine, one or more starch-grains, which not unfrequently are of such size that the green substance forms only a thin coat over them; in many cases, however, the starch forms only a subordinate part of the entire globule, appearing under the form of one or more small nuclei, the diameter of which is only one-half or one-third that of the chlorophyll-globule. The surface of the entire chlorophyll-globule is smoother than in many of the first kind; the green substance ordinarily with finer granules.

The action of water upon these globules is often exceedingly slight, frequently quite imperceptible after a continuance of twenty-four hours. Speaking generally, it is limited to rendering the outlines of the starch-granules more clearly visible, which seems to arise from a little water making its way between the starch-granule and the green substance which forms an envelope around it. The latter remains quite unaltered. When a portion of it is accidentally removed from the starch-grain in making the sections, or when the latter is caused to swell up by the application of an acid, so that the green coat is broken through and stripped off, it may be perceived that the green substance possesses sufficient solidity to preserve its original shape and the cavity in which the starch-grain lay; it is however soft enough to allow of being thrown into coarse folds by lateral pressure. Under these circumstances it presents the characters of a gelatinous mass not swelling perceptibly in water, and, so far as can be seen, coloured green throughout its entire thickness. I never saw vacuoles formed in it. Among the plants I have examined, the internal cells of the leaves of *Ceratophyllum demersum* are best adapted for the investigation of this form of the chlorophyll-globules.

I have remarked above that these two forms of chlorophyll-globule very often pass into one another, but it must be noted in regard to this, that divers forms never occur in the *same* cell, although in different cells of the same plant. For example, it is extremely common to meet with chlorophyll-globules belonging to the first kind in form and size, but containing in their interior one or more grains of starch. In proportion to the diminishing size of these starch-grains (and they are often so small that they can only be recognized as such by the help of iodine after they have been expanded by boiling), the chlorophyll-globules approach nearer to the above-described first variety, devoid of starch, while on the contrary, others in which the starch-grains are larger form the transition to the above-described globules of *Ceratophyllum*. These intermediate forms behave differently with water, being sometimes wholly insensible to it (as for instance, the chlorophyll-globules of *Vallisneria, Potamogeton crispus*, and the central substance of the leaf of *Hoya carnosa*), sometimes swelling out into vesicles in water (*e. g.* those contained in the leaf of *Bromelia Ananas*), under which circumstances the not infrequent isolated starch-grains lie free in the water filling the vacuoles, and exhibit molecular motion.

With regard to the distribution of the two forms of chlorophyll in different cells of the same plant, a general rule exists. In the outer layers of cells, both of bark and of the two faces of leaves, occur globules containing no starch, or others with starch-grains only of exceedingly small size, and ordinarily, like the former, swelling up vesicularly in water. In the layers of the bark bordering on the wood, and in the middle layers of leaves, on the other hand, occur globules possessing comparatively large starch-grains, better resisting the action of water. However, we do not find both kinds of globule in every leaf; there are plants in which all the layers of the leaf, even the middle, contain only chlorophyll-globules without starch. It will not be superfluous to name certain plants in which the diversities just noticed may be recognized.

Chlorophyll-globules without starch occur in all the layers of the leaves of *Elymus arenarius, Iris germanica, Scilla maritima, Tulipa Gesneriana, Phormium tenax, Yucca gloriosa, Clivia nobilis, Menyanthes trifoliata, Ilex Aquifolium, Aralia trifoliata, Sedum Telephium, Cochlearia officinalis.*

Leaves where the outer layers contain chlorophyll-globules without starch, while in those forming the middle substance of the leaf, starch occurs, are found in *Acrostichum alcicorne, Stratiotes aloides, Potamogeton crispus, Piper magnoliæfolium, Camellia japonica.*

Leaves in which all the chlorophyll-globules contain starch, where however those in the outer layers of cells approximate to those devoid of starch, while those situated in the middle of the leaf contain large starch-grains, occur in *Billbergia zebrina, Bromelia Ananas, Vallisneria spiralis, Viscum album, Ceratophyllum demersum, Hoya carnosa.*

In regard to the preceding enumeration, it must be observed that the statement, whether the starch exists or not in the chlorophyll-globules, refers only to the fully-developed leaf, and not to its earlier stages of development, since the starch-grains and the green substance of the chlorophyll-globules by no means exhibit in all cases uniform development and equal duration*.

Especial theoretical interest has attached to the relative conditions of starch and chlorophyll, since Mulder (Physiological Chemistry, Edinb. 1849, p. 286) deduced the cause of the excretion of oxygen gas by green plants from a conversion of starch-grains into chlorophyll. According to Mulder's view, the starch-grains always furnish the material for the formation of the wax constantly combined with the green colouring matter, and he therefore believes that the formation of the green substance of the chlorophyll-globules (composed of wax and colouring matter) is connected with a gradual transformation, advancing inward from the surface, and finally a disappearance of the starch-grains. This transformation of the starch into wax would give rise to an abundant excretion of oxygen gas, and hence plants would not exhale oxygen because they *are* green, but while they are *becoming* green, since under the influence of light they constantly form new colouring matter (probably from proteine), and the wax combined with this from starch.

It certainly is worth the trouble to investigate how far this theory agrees with the results of anatomical investigation. In reference to this, we have to ascertain, whether starch in all cases precedes chlorophyll; whether the form of the chlorophyll is compatible with the assumption of its origin from starch-grains, and whether the increase of the size of the mass of chlorophyll is combined with a diminution of that of the starch-grains.

The solution of the first question is less easy than it appears at first sight, since, from the almost universal diffusion of starch, and the circumstance that young organs, and especially young leaves, are mostly very rich in it, it is not easy to find cells which are free from starch in their earlier stages of development and subsequently produce chlorophyll. I believe, however, that such cases do distinctly occur. For instance, in the leaves of *Stratiotes aloides* I saw no starch precede the chlorophyll-globules, neither did I find it in the chlorophyll-globules which became developed subsequently; further, in several species of *Selaginella*, in the points of the stems and in the youngest leaves I could find no trace of starch, neither could I detect it in the chlorophyll-globules subsequently produced. Therefore we cannot consider the presence of starch-grains a necessary condition for the formation of chlorophyll.

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* [We can hardly imagine that the diversities above indicated are regular and constant characteristics of the plants. It seems far more probable that they point to conditions of the nutritive processes in the leaves in question. For we see the chlorophyll-corpuscles of the Confervoid Algæ, as also those of the Mosses, Hepaticæ, prothallia of Ferns, &c., passing through these various stages in the same cells. The presence of starch in the chlorophyll indicates a previous active assimilation of food; it is accumulated in the Confervoids, &c. as the cells acquire their full size, and especially if these remain long at rest before dividing; it is dissolved and disappears when the green contents (which at the same time lose much of their granular character) are about to be converted into zoospores. The starch reappears in the contents of the zoospores soon after they have become encysted and begun to germinate.—A. H.]

With regard to the second question, whether the form of the chlorophyll is compatible with the assumption of its origin from starch-granules, the affirmative must be admitted unconditionally in reference to chlorophyll-globules. When however Mulder attributes a similar origin to the other forms, assuming that amorphous chlorophyll is produced by the fusion of large groups of starch-grains converted into chlorophyll, the assumption is completely opposed to the anatomical facts; for it is never observed that the chlorophyll-bands of *Zygnema*, the chlorophyll-membrane of *Ulothrix*, *Draparnaldia*, &c., the peculiarly-shaped chlorophyll of *Anthoceros*, &c., are represented in young cells by collections of starch-grains. Observation demonstrating that these forms do not originate from starch, this reason alone must render such a derivation of chlorophyll extremely improbable. But besides all this, the whole of Mulder's conception rests upon a mistaken view of the composition of the green substance of chlorophyll, of which he assumes, that it is soluble in alcohol, and consists of green colouring matter and wax; while I think I have abundantly demonstrated that the principal mass consists of a substance allied to protoplasm, which certainly cannot originate from a metamorphosis of the constituents of starch.

Nevertheless, if not in all, yet in the majority of plants where the chlorophyll-globules contain starch, the latter might serve for conversion into the wax combined with the green colouring matter; if this were the case, one would imagine that the development of the green substance of a chlorophyll-globule would be accompanied by a diminution of the size of the starch-granules contained in it. In proof of the actual existence of this condition might be advanced the circumstance, that in many plants we find starch-grains in the chlorophyll-globules of very young leaves, while in those of full-grown leaves they are no longer met with. Yet it must appear doubtful whether these starch-grains furnish an essential contribution to the formation of the chlorophyll-globules, when we take into consideration their relative dimensions, for we then see that they are insufficient for the purpose. Thus, for example, in *Sedum Telephium*, inner leaves (about a line long) of the bud contain chlorophyll-globules in which the starchy nucleus forms the greatest part of the whole grain, and has a diameter of from $\frac{1}{2800}$ to $\frac{1}{1500}$ of a line. In the outer leaves of the bud, grown up to a length of 7 lines, the starch had vanished from the chlorophyll-globules, and the latter had attained a size of $\frac{1}{500}$ of a line. Their development however was not complete here, for although the starch had disappeared, the chlorophyll-globules still exhibited increase, and in the full-grown leaves had reached $\frac{1}{350}$ of a line. Moreover there is certainly no general rule that starch decreases in size or becomes entirely absorbed with the development of the chlorophyll, for, on the contrary, it is quite as common to find that the starch-grains situated in the chlorophyll are extremely small in young leaves, and increase in size with the chlorophyll-globules, and indeed in comparatively greater degree, so that in the young chlorophyll-globules the green envelope is proportionately far thicker than it is in the full-grown mass; as occurs, for example, most distinctly in *Ceratophyllum*.

Gathering all these points together,—the occurrence of chlorophyll in cells which contained no starch; the occurrence of membrane-like chlorophyll-structures not preceded by any corresponding starch-structure or accumulations of starch-grains; the growth of chlorophyll-globules after the starch-grains have vanished from them; the simultaneous increase in size of starch and chlorophyll-globules in other plants;—we are necessarily led to the conclusion, that chlorophyll is not produced by the transformation of starch-grains, but that the two structures, though frequently connected together, originate independently of each other. The starch may exist earlier, and the chlorophyll accumulate around the starch-grains as around a nucleus—as may be seen so clearly in the internal, starch-bearing cells of a potato when exposed to the light, and, in extremely numerous cases, in the leaves of buds; and, on the contrary, the starch-grains lying in chlorophyll-globules may increase in size independently, and even be formed in chlorophyll which originally contained no starch.

December 1854.

[My own observations fully confirm the statement that starch-grains may originate in chlorophyll-globules at first totally devoid of starch; I have traced the formation of groups of starch-grains in this way in the interior of chlorophyll in the Hepaticæ and other Cryptogamous plants. There can be little doubt that the chlorophyll belongs to the protoplasmic substances of the cell-contents, and is capable of producing starch equally with the colourless protoplasm. From the mode in which starch-grains are formed both in chlorophyll and in colourless protoplasmic masses, I am inclined to regard it as a product formed by deposit or secretion on the *inside* of cavities or vacuoles of the latter, by a process analogous to the formation of the cellulose layers on the outside of the primordial utricle*. I do not find the protoplasmic nucleus described by Cruger in all starch-grains. This would account for most of the phænomena observed. At the same time it would afford an argument for those who doubt the distinct existence of a determinate layer or primordial utricle on the outside of the protoplasm. Our author's statements as to the *pellicular* character of the apparent membrane described by Nageli on starch and chlorophyll-corpuscles, would seem to apply to some extent to the so-called *primordial utricle*. Pringsheim has recently published some important observations on this head, which I trust to be able shortly to test and report on in this Journal.—A. H.]

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* [The observations of Mr Grundy (see *ante*, p. 386 of this volume) agree in some respects with those I have made in a great variety of cases, but the striæ are certainly not superficial, and I doubt the existence of the outer membrane. I think there is merely a *pellicle* of protoplasm, coagulated on the starch-grain when reagents are added. This would appear to dip between the constituent grains of groups, in some cases, however, the interposed pellicle becomes obliterated, and the groups, mostly *pairs* in such cases, have the outer layers common over the whole. It seems to me that there is a fallacy in the various accounts of the membrane of the starch-granule, founded on the experiment of boiling starch, assuming as I do, after repeated experiments, that the main body of the structure is that of concentric laminæ of a tough material. If there were an enclosing membrane distinct from the starch-layers, thick enough to bear expanding to many hundred times its original superficial dimensions, this *must* be thick enough when unexpanded to be clearly visible as a well-defined coat. The saccate bodies obtained by boiling really result from the whole softened substance of the granules becoming blown out (like india-rubber bottles) by a process of endosmosis. The internal substance softens and absorbs water more readily than the outer,—a sufficient cause for the endosmosis. This difference of condition of the layers is proved by an experiment I have repeatedly made with fresh potato-starch. If we attempt to cut it with a knife, it breaks with a roughish fracture, like a lump of partially hardened clay; if the fragments are placed in *cold* water, the internal part of the starch will often swell and protrude irregularly, while the outer layers retain their shape. I cannot confirm Mr. Grundy's statement, that the "skins" can be boiled until they no longer take the blue (or bluish) colour with starch. Still, since after boiling, as in treatment with sulphuric acid, the colour of the substance with iodine tends more and more to pinkish purple, it is possible that long boiling may change the condition, just as roasting does.—A. H.]

XXXVII.—*On* Perna quadrata, *Sow.* By JOHN LYCETT, Esq.*

THE present notice of a fossil shell, which has already been figured and described, requires some explanation.

The *Perna quadrata* of the 'Mineral Conchology,' t. 490. f. 2, represents a very inequivalve *Perna*; but as the specimen figured appears to have been somewhat imperfect, and as it was placed by the artist in an unfortunate position and is seen only from a single point of view, it affords a very insufficient aid to a description which is substantially correct as far as it refers to the only specimen which appears to have been at the disposal of the author. With such an illustration it will not afford surprise to find that Phillips in his Geology of Yorkshire, t. 9. f. 24, represented a second and very different shell under the name of *Perna quadrata*; and as the latter work contains no descriptions of species, Goldfuss was in turn also misled to figure a third *Perna* distinct from both the others under the same name (Petrefacta, t. 108); upon the same plate however is *Perna rugosa*, which is identical with the *quadrata* of Phillips; the latter is an equivalve, squamous, thick shell, well known to collectors of British Inferior Oolite fossils. There is another inducement to acquire a correct knowledge of the original *Perna quadrata*, inasmuch as the species is a very remarkable one, constituting a departure from the typical forms of the *Pernæ*, and approaching to others of the kindred genus *Inoceramus*. The diagnosis of the shell in the 'Mineral Conchology' is as follows:—"Quadrilateral, one side shorter than the other three; valves gibbose, unequal, the shorter side very concave, bounded by two obtuse carinæ."

The figure in the 'Mineral Conchology' has the right or flattened valve facing the spectator; the contour of the larger or convex valve therefore is not seen: the shell is not placed upright upon the page, the lower border forming the right-hand side of the figure: even the outline is not perfect, as there seems to be a portion of the lower border wanting, and thus forming an angle at its anterior extremity, which would be rounded were that part entire.

The typical *Pernæ* are equivalve or subequivalve; their fibrous tests are squamous externally, and acquire great thickness with advance of growth; the valves are so much flattened, that their attenuated apical extremities have not more thickness or convexity than the corresponding parts of the *Pinnæ* and *Mytili*; the hinge-plate is always broad, the greater length of the valve being always perpendicular to, or in the opposite direction to the line of the hinge-plate. *Perna quadrata*, on the contrary, is very inequivalve, and with advance of growth it becomes almost gryphoidal; the umbo of the larger valve is very prominent, straight and incurved; the anterior side of the valve is steep, with a large excavation, byssal aperture and corrugated border; the posterior side is much compressed, and extended into a kind of imperfect wing; the hinge-plate is narrow, its border is much lengthened, so that the greater length of the valve is in that direction, and the shell is transverse; the narrow hinge-plate renders the ligamental grooves very short, their diameter laterally being equal to their length, as is often seen in the genus *Gervillia*; they diminish rapidly, so that the posterior half of the hinge-line is destitute of hinge-plate and grooves. The byssal aperture is formed by the larger valve only. In both valves the test is very thin, excepting at the prominent umbo and anterior side of the larger valve; the surface, unlike that of the typical *Pernæ*, is smooth; the right valve has little convexity, and its umbo little prominence; its anterior border is thickened as in the other valve.

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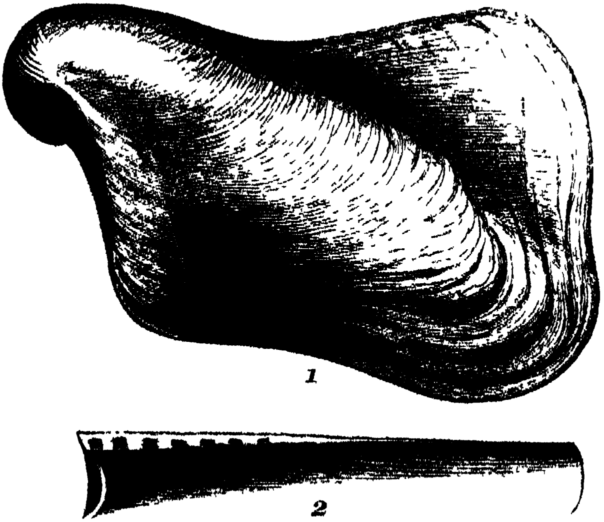
* Read to the Cotteswold Naturalists' Club, January 30th, 1855.

In the *Pernæ*, as in the *Inocerami*, much variability exists in specimens of the same species, the result not only of different stages of growth, but also of individual peculiarities. All the specimens of *Perna quadrata* differ more or less from each other



Perna quadrata, Sow.
1. Exterior of the convex valve.
2. Hinge-plate of the flattened valve
(Reduced one-fourth.)

and from the figure in the 'Mineral Conchology,' so that the identity of these specimens with Sowerby's shell has not been ascertained without the examination of a considerable number of examples. The contrast which *Perna quadrata* presents to the typical *Pernæ* is therefore very great; its general aspect is in fact that of an *Inoceramus*, more especially of the subinvolute forms of the latter genus, from which it is distinguished only by the anterior excavation and aperture; but as this feature is one only of subordinate value when viewed singly, there would seem to need the addition of some other distinctive features ere we are enabled to affirm the clear generic separation of *Perna* and *Inoceramus*. The oblong flattened figure of the smaller valve and the thinness of the test might cause it to be mistaken for a *Crenatula* when the hinge-plate is not exposed. *Perna quadrata* may therefore be regarded as the type of a group of inequivalve transverse shells, whose relation to the typical *Pernæ* may be compared with that which certain aberrant species of the kindred genera *Inoceramus* and *Gervillia* bear to their respective typical groups. Of the Jurassic forms more especially may be instanced the large *Gervillia Hartmanni* and *G. tortuosa*, compared with the flattened subequivalve species of the same genus; in these and other instances the inequality of the valves becomes more marked with advance of growth. The very perfect preservation of the hinge-plate, together with the condition of the tests of associated bivalves, forbids the supposition that the thinness of the test has been produced by the removal of thick nacreous layers from the inner surface.

Dimensions.—Length of our largest specimen in the direction of the hinge-line 5¼ inches, height 3¾ inches, convexity of the larger valve 2 inches.

Geological position and localities.—The specimen figured in the 'Mineral Conchology' is from the Cornbrash of Bulwick; our own specimens are from the freestone portion of the Inferior Oolite near Nailsworth, from a quarry in Woodchester Park, worked for the purposes of the Roman Catholic Monastery; specimens have also been obtained in the freestone quarries of Scar Hill in the parish of Minchinhampton, thus affording an additional instance of that general resemblance between the Testacea of the Cornbrash and the Inferior Oolite, which has been noticed by Professor Buckman in a paper on the Cornbrash of Cirencester, and which forms a part of the Proceedings of the Cotteswold Naturalists' Club. The exact position of *Perna quadrata* in the freestone is the two uppermost beds of that rock, immediately underlying the Oolite marl, or in its absence, the cream-coloured hard argillaceous limestone with *Nerinæas* which replaces it in the valley of Nailsworth.

XXXVIII.—*Notes on the Ornithology of Madeira.*
By Edward Vernon Harcourt, Esq.

To the Editors of the Annals of Natural History.

Gentlemen,

Since publishing a short notice of the ornithology of Madeira* in the year 1851, I have received a few additional specimens of birds from that island: I am not aware that any other fuller list than the annexed has yet been drawn up; I therefore send it to you, together with a few remarks corrected from my former observations on the subject, in case you may think them of sufficient interest to merit a place in the 'Annals.'

With one exception, Madeira possesses no birds peculiar to its own shores; although the influence of its genial climate exercises such a modifying power over the tints of its feathered denizens as analogy would lead us to expect. For example, the Greater Redpole or Linnet, which is very abundantly met with in the island, retains its bright carmine plumage through the year; the Herring Gull, also very common, is, according to Dr. Renton, quicker by some months in obtaining its mature garb than with us; and the Black-cap Warbler assumes, in some instances, an intensity of colour, which has led to its being described by Sir W. Jardine as a new species†.

Indeed were it otherwise, it would be a matter of astonishment that birds alone should be exempted from a law of nature by which climate exercises so large a power over those secretions which are the mysterious agents for the production of colour.

The position of Madeira, midway betwixt the temperate and torrid zones, has sometimes given rise to doubts in the minds of geographers as to whether it were most African or European. If considered in relation to its natural productions, its pine-apples, guavas, mangos, shaddocks, and bananas, which ripen a tropical fruitage, would point to a preponderating African affinity; on the other hand, its indigenous birds, with the exception of the Wren, the Chaffinch and the Swift, are all strictly European.

The adaptation of species to the climates they are designed to inhabit can never fail to fill the mind with admiration of the providence of the Creator; and the importance of the study of geographical ornithology has been fully admitted by modern naturalists. Looked upon in this point of view, the smallness of the sphere of observation becomes a matter of secondary consideration compared with its geographical position: accordingly, Madeira, which possesses a range of, at most, thirty-three miles in length by fourteen miles in breadth, rises in interest when we come to view its intermediate situation between the northern and southern hemispheres.

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* Sketch of Madeira. Murray, 1851; and Annals, vol. xii. p. 58.

† Edin. Journ. of Nat. and Geog. Science, Jan. 1830, vol. i. p. 243.

The Kestrel (*Falco tinnunculus*, Linn.) is here very familiar in its habits, and may be seen perched on the roofs of houses in the very centre of the town of Funchal; it preys upon the common lizard of the country (*Lacerta Dugès*, Edw.), on grasshoppers and mice, and occasionally succeeds in snatching the tame canary-birds from between the bars of their reed cages as they hang exposed at the open windows.

The common Buzzard (*Falco buteo*, Linn.) is plentifully met with in the mountains, and the traveller may sometimes come close upon it as he rounds the corner of a projecting rock.

The Barn Owl (*Strix flammea*, Linn.), which is somewhat darker than English specimens of the same bird, inhabits some of the more sombre ravines of the island, though it is by no means a numerous species.

The Blackbird (*Turdus merula*, Linn.) is common in all the woody districts, and is as wary and difficult of access as with us.

The Redbreast (*Sylvia rubecula*, Lath.) is also very common, and is a great favourite with bird-fanciers in Madeira: it sings and thrives in captivity.

The Black-cap Warbler (*Sylvia atricapilla*, Lath.) bears captivity equally well with the Redbreast, and is to be seen hanging caged at almost every door. The variety of this species, which has been alluded to above, is much prized on account of its less common occurrence. Dr. Heineken, after whom the variety was named by Sir W. Jardine under the title of *Curruca Heineken*, wrote a paper* expressing his conviction that this was not a distinct species. The chief difference consists in the extension of the black colour from the cap to the shoulders, and sometimes even over all the under parts: the dimensions of this bird and of the common Black-cap are precisely the same: in the variety, the under parts are generally much the same as those of the common female Black-cap, and the upper parts as those of the common male. I have repeatedly endeavoured to find a nest sat upon or attended by this darker Black-cap, and have also offered rewards to the country folks if they could discover one, but have always failed. The popular belief is, that when the nest of the common Black-cap contains five eggs, one of them will produce a bird of the variety. I have also failed in obtaining a young bird of the dark variety from the nest. Till this has been done, the matter cannot be finally set at rest.

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* Zool. Journ. No. 17. Art. 17.

The Wren (*Regulus Maderensis*, mihi) is the only feathered inhabitant of Madeira which is absolutely peculiar to the island. It is a true *Regulus*, but differs from the three best-known European species, namely *cristatus*, *ignicapillus*, and *modestus*. The following is an accurate description taken from two specimens in my possession:—It has the beak black, forehead white, which colour extends backwards in the form of a small band; the base of the crest is black, the crest itself bright orange, thus differing from *ignicapillus*, which has the crest fiery red; from the beak to the eye there is a small black band, which does not go beyond the eye, and in that respect also it differs from *ignicapillus*; the upper part of the neck and all the back are olive-green, with a bright marking of orange-yellow on each side of the neck; the great wing-coverts are blackish, tipped with buffy-white, and forming a band; the primaries are brownish-black, with a narrow external edging of green; the secondaries are the same, but having a broad velvet-black mark at the base; the tail-feathers are brownish-black, tinged with greenish-yellow on the outer web, the chin and throat are white, slightly tinged with green; the rest of the under parts of the body are white, slightly tinged with yellowish-green; the under wing-coverts are white; the legs pale brown; the entire length is four inches; from the carpus to the end of the wing two and a quarter inches; the length of the tarsus is three-quarters of an inch; the middle toe and claw half an inch; the fourth, fifth and sixth quill-feathers are of equal length, and the longest in the wing. Believing that a bird of this species can have but a limited range, and not finding it even in the list of birds of the Canary Islands given by Webb and Berthelot, or in any of the lists of African birds with which I am acquainted, I have ventured to call it "*Regulus Maderensis*." The sex of the two birds in my possession was not noted, but from the brightness of their colours, which surpassed those of the Fire-crested, they were probably males. This bird lives amongst the laurel forests, and principally amongst the *Urze*, or arborescent heath, in the least frequented parts of the island; the Portuguese give it the name of "Abibe."

The Spectacle Warbler (*Curruca conspicillata*, Gould) is very locally distributed. It is found in brakes and bushes, at a somewhat high elevation, and where the solitude is seldom disturbed by man.

The Gray Wagtail (*Motacilla boarula*, Linn.) is very common, frequenting the cisterns which are attached to every house, as well as the streams, or *levadas*, where the washing is carried on, and from its constant attendance upon the women engaged in these pursuits, it has been admitted into the ranks of the sisterhood, under the local title of "Lavandeira."

The Meadow Pipit (*Anthus pratensis*, Bechst.) is plentifully found on the cliffs and fields near the sea, and on the serras. It utters a low note, running along the ground, and never takes a long flight. The natives consider this bird sacred, and have some legend about its having attended the Virgin at the time of the nativity; its local name is "Corre de Caminho."

The Green Canary (*Fringilla butyracea*, Linn.) is the original stock of the bird so well known to us as the Yellow Canary. It has been well described by Dr. Heineken*, who had ample opportunities of observing its habits throughout the year. During the breeding season it is very tame, haunting fearlessly the gardens in the midst of the town; when the breeding season is over, it flocks with linnets and other birds, and it then chiefly frequents the fields and other less populous parts: its song is heard during the greater part of the year. The price of a good singing canary, either in Madeira or the Canary Islands, varies from five to nine shillings, so that, in fact, it may be bought cheaper in London. The reason of this is, the difficulty which is experienced in rearing the wild birds from the nest, and the fact that, although an old bird will often sing soon after it is placed in captivity, it does not long survive its loss of freedom. The cross between the wild and the tame canary seems to produce a bird which is both physically and vocally stronger than its domesticated ancestors.

The Goldfinch (*Fringilla carduelis*, Linn.) is very common, and differs in no respect from our own.

The Ring-Sparrow (*Fringilla petronia*, Linn.) is universally met with in Madeira, on the bleak serras, on trees in the centre of the town, on rocks by the sea, &c.; thus differing in habits, though in nothing else, from the Ring-Sparrow of Europe. It is the only indigenous sparrow in the island.

The "Buff-breasted Chaffinch" (*Fringilla tintillon*, Webb and Berth.) is nearly identical with the bird figured by Webb and Berthelot in their work on the Canary Islands. The Portuguese name for it is "Tentilhão." It is very common in Madeira, and its habits are very familiar; it is occasionally seen in cages, although possessed of no singing powers. I have called it the "Buff-breasted Chaffinch," not being aware of its yet having obtained any other English name.

The Greater Redpole, or Linnet (*Fringilla cannabina*, Linn.), is here very abundant: as has been before remarked, it consorts, out of the breeding season, with the Canary, Goldfinch, Buff-breasted Chaffinch, and other birds; its only local peculiarity is that of retaining its bright carmine colouring throughout the year.

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* Zool. Journ. No 17. Art. 17.

The "Lesser Swift" (*Cypselus unicolor*, Jard.) is mentioned in Brewster's Journal by Dr. Heineken under the title of "Black-chinned Swift:" this peculiarity is, however, by no means universal amongst the species. I have several specimens in my possession with the chin almost as white as that of the common Swift: one of the chief differences between the two is in size, the *unicolor* being much the smallest; I have therefore called it "Lesser Swift;" the tail is forked about an inch and a half, and the plumage is darker than that of the common Swift. The habits of the Swifts in Madeira differ from those exhibited by birds of that genus in England, and Dr. Heineken has assigned the true reason for this difference. Dr. Heineken says*, "The Swallow and Snipe are said to be here periodical visitors, and the reason both for the migratory habits of these birds, as well as for the stationary habits of the Swift and Woodcock, is very readily to be found, I suspect, in one common cause, namely *food*. The Woodcock find its food about spring-heads, the margins of little mountain-rills, &c. These are neither dried up here during our hottest summers, nor frozen in the severest winters. The Swifts prey universally on insects, but throughout the summer on a moth which abounds so on our most parched and sterile serras, that what with the insects and the birds the place seems all alive. The Snipe requires a tolerable quantity of poachy, moist, decomposing soil for the production of its food, and this, even in winter, is both scarce and very local, whilst at other times there is not a square yard in the whole island; and the Swallow requires insects which are found only over streams and something approaching to rivers, which we make but a sorry figure in at the wettest seasons, and are entirely without six months in twelve." The common Swift (*Cypselus murarius*, Temm.) is not quite so plentiful as the Lesser Swift. Both species remain in the island throughout the year.

The Ring-dove (*Columba palumbus*, Linn.) is an inhabitant of the forests on the north side of the island, and is generally to be found in the Funchal markets.

The "Long-toed Wood Pigeon" (*Columba trocaz*, Hein.) has been described by Dr. Heineken in Brewster's Journal: it answers to the *Columba laurivora* of Webb and Berthelot, as given in their work on the Canary Islands. Dr. Heineken merely adopts the local name of *Trocaz*, by which the bird is known in Madeira;

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* Zool. Journ. No. 17. Art. 17.

and the name given by Webb and Berthelot has reference to the nature of its food. It is more plentiful in Madeira than the Ring-dove, and its flesh is considered a great delicacy. A remarkable feature which it possesses, and which points to an adaptation for its habitat amongst large forest trees, is the great length of its centre toe, being more than an inch longer than that of the Ring-dove; I have therefore called it "Long-toed Wood Pigeon," in default of any other English name. It has a silvery ring which goes all round the neck, and is darker in its general plumage than the Ring-dove. It feeds upon water-cresses, grasses, and the acorns of the *Laurus fœtens, Laurus indica,* and other trees growing in the forests on the north side of the island.

The Rock Pigeon (*Columba livia,* Briss.) is plentifully found on the sea cliffs and rocks, and in the ravines, which it inhabits all over the island. There is also a variety here of this bird, which appears to be darker in the colour of its feet and in its general plumage than the common Rock Pigeon. Purchas, in his early remarks upon Madeira, relates that "at first the pigeons suffered themselves to be taken, not knowing, and therefore not fearing, a man."

The Red-legged Partridge (*Perdix rubra,* Briss.) is not uncommon on the wild serras. The running propensities of this bird make it difficult of access to sportsmen even on the flattest ground, and when the pursuit has to be carried on upon the sides of mountains which rise some 6000 feet above the sea, the toil would seem out of all proportion to the reward. The professional *Caçador* is consequently almost the only enemy which the Partridge meets with in Madeira.

The Quail (*Perdix coturnix,* Lath.) is more plentiful here than the Partridge, and approaches nearer to the habitations of man; it pairs, laying sometimes as many as sixteen eggs, and bringing off three or four broods in the year. The shooting this bird amongst the yam-gardens affords excellent sport.

The Woodcock (*Scolopax rusticola,* Linn.) is found chiefly on the west side of the island, and on the Paül da Serra is very plentiful. The native sportsmen generally shoot it in the evening: they wait till it comes to feed at the mountain rills, and often kill several on the ground at one shot.

The Tern (*Sterna hirundo,* Linn.) appears mostly at the Dezerta Island, occasionally visiting various parts of the Madeiran coasts.

The Herring Gull (*Larus argentatus,* Brunn.) abounds everywhere.

The Cinereous Shearwater (*Puffinus major,* Temm.) breeds plentifully on the Dezerta Islands. This bird, as well as the

Manks Shearwater with which it is sometimes confounded, is salted by the natives and considered eatable.

The Manks Shearwater (*Puffinus Anglorum*, Ray) is also very common.

The Dusky Petrel (*Puffinus obscurus*, Temm.), another inhabitant of the Dezertas, may be easily distinguished from the foregoing species, which it strongly resembles, by its inferior size as well as by the colour of its feet. The *Anglorum* has the feet of a flesh-colour, whereas in *obscurus* they are of a bluish ash-colour. *Anglorum* has likewise all the secretions yellow, but in the case of *obscurus* they are of a dark green colour. Both *Anglorum* and *obscurus* may be easily tamed, and will live upon almost anything. They run along the ground on their bellies, and use their curiously-shaped bills in climbing up the rocks. Their habits are crepuscular, and in the daytime they hide themselves in any holes or crannies within their reach.

Bulwer's Petrel (*Thalassidroma Bulwerii*, Gould) has been described by Sir W. Jardine*, who says, "it is easily distinguished from any other by having the two centre tail-feathers elongated, as in the genus *Lestris*, and not even or forked like the other Petrels." This Petrel is identical with that described by Dr. Heneiken under the title of *Procellaria anginho*; and has also been called *Puffinus columbinus* by Webb and Berthelot in their work on the Canary Islands. Dr. Heineken describes it as having no white about the rump or flanks, and as having the tail *slightly forked*. Mr. Yarrell has justly observed, that the squareness or forkedness of the tail in Petrels is an unfair criterion of species, as this property in a very great measure depends upon the age of the individual, and varies accordingly. The plumage of this Petrel is entirely uniform brownish-black, and it is very common on the Dezerta Islands.

The Forked-tailed Petrel (*Thalassidroma Leachii*, Temm.) is also found on the Dezertas. This bird was described† under the title of *Thalassidroma Castro*‡, from a supposed difference which appeared to exist between the measurements of specimens from Madeira and those from other parts. Specimens from Madeira seemed to exhibit shorter wings and shorter tarsi, though the entire length of the birds was greater. The tails also of the Madeiran birds appeared to be square instead of forked. This latter characteristic, as has before been observed, forms no safe criterion; and Forked-tailed is not quite so distinctive an appellation for the species as might be desired.

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* Illustrations of Ornithology, by Jard. & Selb.; and Edinb. Journ. of Nat. and Geog. Science, Jan. 1830, p. 245.

† "Sketch of Madeira," Murray, 1851, p. 123.

‡ Roque de Castro is the local name of this bird.

I have now come to an end of the list of birds which may be strictly called natives of Madeira. There are, however, many other occasional or accidental visitors to the island, and these come chiefly from the African coasts. The most common of these stragglers are the Sparrow-Hawk, Greenfinch, Hoopoe, Common Heron, Night Heron, Godwit (Black-tailed), Common Curlew, Greenshank, Great Snipe, Gallinule, Coot, Wigeon, and Kittiwake.

The following is a list of the birds of Madeira, which, although it is the fullest I have been able to obtain, is capable doubtless of being much increased by future observers.

Those marked thus * are natives of Madeira.

Cathartes percnopterus, *Temm.*
Falco nisus, *Linn.*
—— subbuteo, *Linn.*
*—— tinnunculus, *Linn.*
*—— buteo, *Linn.*
*Strix flammea, *Linn*
Corvus corax, *Linn.*
—— corone, *Linn.*
Oriolus galbula, *Linn*
Sturnus vulgaris, *Linn*
Turdus iliacus, *Linn.*
—— musicus, *Linn.*
*—— merula, *Linn.*
*Sylvia rubecula, *Lath.*
*—— atricapilla, *Lath*
—— hortensis, *Lath.*
*Curruca conspicillata, *Gould.*
*Regulus Maderensis, *mihi*
Troglodytes Europæus, *Selb.*
*Motacilla boarula, *Linn*
—— alba, *Linn.*
Alauda arvensis, *Linn.*
*Anthus pratensis, *Bechst.*
Fringilla chloris, *Linn.*
—— domestica, *Linn.*
*—— butyracea, *Linn.*
*—— carduelis, *Linn.*
*—— petronia, *Linn.*
*—— tintillon, *Webb & Berthelot*
*—— cannabina, *Linn.*
Cuculus canorus, *Linn.*
Musaphaga Africana, *Temm.*
Upupa epops, *Linn.*
s apiaster, *Linn.*
ispida, *Linn.*
*Cypselus unicolor, *Jard.*
*—— murarius, *Temm.*
Hirundo urbica, *Linn.*
—— rustica, *Linn.*
—— riparia, *Linn*

Caprimulgus Europæus, *Linn*
*Columba trocaz, *Hein.*
* —— palumbus, *Linn*
*—— livia, *Briss.*
—— œnas, *Linn.*
—— turtur, *Linn.*
Œdicnemus crepitans, *Temm*
Calidris arenaria, *Ill.*
Vanellus cristatus, *Meyer*
Charadrius hiaticula, *Linn*
—— pluvialis, *Linn.*
Strepsilus interpres, *Leach*
Ciconia nigra, *Temm*
Ardea cinerea, *Lath.*
—— ralloides.
—— russata, *Wagler*
—— purpurea, *Linn.*
—— minuta, *Linn.*
—— stellaris, *Linn.*
—— nycticorax, *Linn.*
Platalea leucorodia
Limosa melanura, *Leisler.*
Numenius arquata, *Lath.*
—— phæopus, *Temm*
Tringa pugnax, *Linn.*
—— subarquata, *Temm.*
—— variabilis, *Meyer.*
—— cinerea, *Temm.*
Totanus hypoleucos, *Temm.*
—— glottis, *Bechst.*
*Perdix rubra, *Briss.*
*—— coturnix, *Lath.*
*Scolopax rusticola, *Linn.*
—— gallinago, *Linn.*
—— major, *Temm.*
Crex Baillonii, *Temm.*
—— pratensis, *Selb*
Porphyrio Alleni.
Gallinula chloropus, *Lath.*
Fulica atra, *Linn.*

Anser segetum, *Steph.*
Mareca Penelope, *Selb.*
Anas crecca, *Linn.*
*Sterna hirundo, *Linn.*
—— nigra, *Linn*
—— Dougalli, *Mont.*
*Larus argentatus, *Brunn.*
—— tridactylus, *Lath.*
Lestris cataractes, *Temm.*
Colymbus glacialis, *Linn*

Sula alba, *Temm.*
Procellaria mollis, *Gould.*
—— Pacifica, *Aud.*
*Puffinus major, *Temm.*
*—— Anglorum, *Temm.*
*—— obscurus, *Temm.*
*Thalassidroma Bulwerii, *Jard*
*—— Leachii, *Temm.*
—— pelagica, *Temm.*

I have the honour to remain, Gentlemen,
Your obedient servant,
EDWARD VERNON HARCOURT.

20 Portland Place, London,
May 11, 1855.

XXXIX.—*On the Characters which distinguish the Vegetation of a Country.* By M. ALPHONSE DECANDOLLE*.

THE vegetation of any particular country or district always presents more or less important and distinct characters. These are numerous; and few authors in writing Floras, or memoirs on botanical geography, ever think of enumerating the whole of them, still less of regarding them according to their actual degree of importance.

These characters relate to the conditions of the classes, or great divisions of the vegetable kingdom, the families, genera and species, in the country treated of, and also to the analogies and differences presented by them in comparison with other regions. The following enumeration will show the multiplicity of these points.

I. ENUMERATION OF THE CHARACTERS.

1. *Characters relating to Classes.*

Proportion of Phanerogamia and Cryptogamia.—In the actual state of our knowledge it is of very little use to seek to determine this proportion; and, moreover, if we knew it elsewhere than in Europe, it is doubtful whether it would present any true interest. The *species* being ill-defined and imperfectly known amongst the Cryptogamia, and the structure, appearance and position of these plants being extremely diverse, and usually without analogy with those of the Phanerogamia, it is difficult to say what would be the object or the result of such a comparison.

Proportion of Dicotyledones and Monocotyledones.—Few numerical data are so frequently given in botanical geography, and yet this proportion is usually inexact, and not very important to be known.

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* From the Bibliothéque Universelle de Genève for December 1854.

It is not always correct, seeing that the Cyperaceæ and Gramineæ, which constitute the greater portion of the Monocotyledones in most countries, and the Orchideæ in some warm and moist regions, are precisely the families of the exact number of which we know least. There are many Floras, even of European countries, in which the number of Cyperaceæ is very incomplete. As a general rule, the more completely the Flora of a district or province is known, the more does the proportion of Monocotyledones increase; but this is probably not the case with the Floras of very extensive countries, from another cause to which I shall refer hereafter, a cause which has escaped the attention of authors who are generally very judicious.

The comparison of the numbers must not be made between countries of unequal extent, because the average area* of the species of Monocotyledones is much larger, at least in our temperate and northern regions, than the average area of the Dicotyledones. In the Flora of a province we meet with the greater part of the Gramineæ, Cyperaceæ, and Juncaceæ which exist in an extensive region around this province. The more extended the space under consideration, the more are local species added to the Flora, and these are most frequently Dicotyledones. The following are a few examples in confirmation of this.—

The Flora of the department of Maine-et-Loire, by M. Guépin (ed. 3), shows the proportion of the Monocotyledones to the Dicotyledones to be 1 : 3·2. The Flora of the same department, with several others of the centre of France, by M. Boreau, gives the proportion 1 : 3·5; and that of the whole of France, according to the Botanicon of M. Duby, =1 : 4·3. To give these fractions in a more complete and logical form, I will say that in the department of Maine-et-Loire the Monocotyledones constitute 23·7 per cent. of the phanerogamous plants, in the central departments of France (including the preceding) 22·2 per cent., and in the whole of France 18·8†.

If we could extend our observations to the whole of Europe, we should probably find a still greater proportion of Dicotyledonous species; for, without speaking of the secondary families, there are many more Gramineæ and Cyperaceæ common to the two extremities of this vast region, than Compositæ or Leguminosæ. It is true that, in taking the proportion from very limited Floras, such as those of the environs of towns, we may sometimes find the amount of Dicotyledones nearly as great, or even greater, than in the entire province in which the town is situated*; but the environs of a town do not usually present all the varieties of station which are indispensable to species, and hence arise accidental causes which prevent the exemplification of the law. A town surrounded by hills or mountains will have more Dicotyledones, and one environed by moist meadows more Monocotyledones, than the general conditions of the region would lead one to expect.

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* The *area*, in botanical geography, is the surface occupied by a species, a genus, or a family.

† The cultivated species are excluded from these numbers We find the same differences in taking separate portions and the whole of the German Floras, between the Adriatic and the Baltic. Thus, in Dalmatia, the proportion is 1 : 3·5, according to M. Visiani's Flora (vol. iii. p. 390); in Lower Austria, 1 : 3·7 (Neilr. Fl. Wien. p. xxxi); in Wurtemberg, 1 : 3·1 (Schubler and Martens, p. xv), in the Kingdom of Saxony, 1 : 3·5 (Reichb. Fl. Sax. ed. 1844); in Silesia, 1 : 3·2 (Wimm. and Grab. Fl. 2. p. 95); in the province of Prussia, 1 : 3·2 (E. Mey. Fl.). For the whole of Germany the proportion, according to Furnrohr (Fl. de Ratisb. p. xxxi), is 1 : 3·7, or including the Austrian possessions on the shores of the Adriatic (Koch, Syn. ed. 1. p. lx), 1 : 3·8.

Of the two causes of error to which I have just referred, the former, the imperfect knowledge of the Monocotyledones of partially explored countries, is usually the most serious. The second, the unequal extension of the species, is of less importance; and it may, moreover, be got rid of by taking care only to compare countries of nearly similar extent.

But there are more serious objections to the calculations in question. The Monocotyledones are far from being homogeneous. What conclusions can be drawn from a number which includes Orchideæ or Irideæ, Palms, Gramineæ, Cyperaceæ or Juncaceæ, in very different quantities according to the countries, to be afterwards brought into comparison with the Dicotyledones? Are the thousands of Orchideæ, or the hundreds of Palms of Brazil, analogous to the Cyperaceæ or Liliaceæ of our regions? and nevertheless it is to these, under the common name of Monocotyledones, that the Dicotyledones of different countries are compared. The error is still further augmented by the custom of regarding the number of Monocotyledones as unity with regard to that of the Dicotyledones; for this apparent unity varies, and the elements composing it in some regions have the value of plants with a simple, in others with a complex organization; in one place they are insignificant herbaceous plants, in another woody plants, or even large trees. I may also remark, that the frequency of the individual plants, and their influence on the vegetation of a country, have no relation with the number of species in each group.

From all these causes, therefore, the proportion of the species of Monocotyledones and Dicotyledones is an abstract fact, which may be calculated from Floras, but which *is not evident in nature*. I defy the most practised botanist to determine at the first glance what is the proportion of the two classes, even in a limited district. On the contrary, it is easy, at first sight, to say whether the Compositæ, the Leguminosæ, or evergreen plants predominate in a region, because these groups are more homogeneous, more easily seized in their totality and compared to one another. It would at least be necessary, to give any importance to the proportion of the two great classes, that the composition of each should be added, particularly in the case of the Monocotyledones, the forms of which are so very different.

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* Round Ratisbon the proportion is 1 : 3·5 (Fürnrohr); round Vienna, 1 : 3·6 (Neilreich); round Strasburg, 1 : 3·4 (Kirschl. in Flora, 1843, vol. i p 196); round Wurtzburg, 1 : 3·3 (Schenk, Flora, 1849, p. 61).

Proportions of the Natural Groups superior to the Families, but inferior to the Classes.—Botanists have endeavoured to associate the families in groups inferior to the great divisions of the vegetable kingdom, but still founded upon positive characters; but these attempts are as yet too recent and too imperfect to be capable of employment in botanical geography. It would be premature to calculate the proportions of the species in these groups, which are only provisional, or at all events ill-defined. Other associations, of rather small botanical value, but which still repose upon very apparent characters, merit more of the attention of the geographical botanist.

The proportions of the *woody* and *herbaceous* species, or of *annual*, *biennial*, *perennial* and *woody* species, whether *monocarpous* or *polycarpous*; the proportion of species with *fleshy* leaves or stalks, or succulent plants; that of the species with *compound*, or with *persistent* and *deciduous* leaves,—these are elements that should be ascertained in every assemblage of plants. Each of these groups includes plants of various families or classes; but their importance in nature is evident. The number of woody species, trees especially, has an actual value, by reason of the aspect of forests and their positive action upon herbaceous plants. In this point of view, statistical observations upon the extent of the forests in a country are by no means without value. I may even say, that a statistical table, showing the proportion of forests, cultivated land, meadows, marshes, &c., will give more information regarding the general vegetation of a country, than certain Floras which exhibit a great deal of learning, and which are in high estimation amongst botanists.

Some attempts have been made to arrange the forms of plants in certain categories, answering to the aspects they bear in nature. Von Humboldt*, and after him Meyen†, have distinguished in this manner from fifteen to twenty of what may be called *physiognomic* groups of plants. This is a means of facilitating the descriptions of travellers. There is certainly a great number of forms which are not sufficiently marked to enter into any one of these categories in particular; or rather, there are forms which are so abundant and common, that they include the great majority of the species of every Flora. Hence perhaps the little practical use that can be made of these divisions.

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* Essai sur la Géographie des Plantes, 4to, p. 31, and Tableaux de la Nature, 1851, ii. p. 22.

† Grundriss der Pflanzengeogr. iii. p. 117.

2. *Characters relating to the Families.*

Proportions of the Species of different Families to the Phanerogamia.—The calculation usually made to express the proportions of the families in a country, supposes implicitly that the species of different families are equally abundant in individuals in the same country. This, however, is not the case, and we should probably arrive at a more correct idea by ascertaining what are the commonest species, and calculating the proportions of the families from these species. Unfortunately, the collection of data as to degrees of frequency is a difficult matter; where existing they are rather vague, and, for most countries, they are entirely wanting.

Besides, the average area of the species varies according to the families and regions. Thus, under similar conditions, the more extended the space under consideration, the greater is the addition of different species belonging to certain families in which the specific areas are limited in comparison with other families in which the areas are larger. In a central region of Europe, for example, we meet with a small proportion of the Leguminosæ, Labiatæ, or Compositæ, which exist in the whole of Europe, but with a large proportion of the Cyperaceæ, Juncaceæ, or Gramineæ; consequently, the proportions of these families will be very different, according as we regard the supposed central region or the entire continent. The former of these families will have a greater number in the whole of Europe; but, nevertheless, in the particular district, they will be of no greater importance than is shown by the local Floras. Let us see how serious this cause of error may be. We can only appreciate it in Europe, as elsewhere the enumerations of species of regions included within others are either wanting or defective.

I shall confine myself to the comparison of the Leguminosæ, Compositæ and Gramineæ, as the Cyperaceæ are often incomplete, even in European Floras, and the other families are not sufficiently rich in species to render the proportions independent of errors and local circumstances. I shall take my examples of countries from the continent and under the middle latitudes.

I shall first compare the department of Maine-et-Loire according to the Flora of M. Guépin, the departments of the centre of France according to the Flora of M. Boreau, and the whole of France according to the Botanicon of M. Duby. The cultivated species are excluded throughout*.

	Maine-et-Loire. (1304 Phan.)		Centre of France. (1530 Phan.)		France. (3615 Phan.)	
	Species	Proportion to the Phanerog	Species.	Proportion to the Phanerog.	Species.	Proportion to the Phanerog.
Leguminosæ . .	92	0·070	109	0·071	325	0·087
Compositæ . .	123	0·091	156	0·102	478	0·132
Gramineæ . . .	110	0·084	119	0·077	249	0·069

It will be seen from this how incorrect it would be to make a comparison between the proportions of the families in a department of France and in a country of the size of Germany, and still more in an immense region such as the United States or New Holland.

By ascertaining the proportions of the Compositæ, Gramineæ or Leguminosæ as compared with the Phanerogamia in all the departments of France successively, and taking the averages, we should not obtain the same proportions that would be found from the Flora of the whole of France; and the error would be sometimes in one direction, sometimes in the other, according to the relative specific areas of the three families.

The following is another example, taken from Alsace and Germany. I shall compare, 1. the Flora of Strasburg by Kirschleger; 2. that of Baden, Alsace, Rhenish Bavaria, and Schaffhausen by Grisselich; and, 3. that of Germany, including Istria and Switzerland, according to Koch, deducting the cultivated species.

	Strasburg. (960 Phan.)		Baden, Alsace, &c. (1352 Phan.)		Germany. (3131 Phan.)	
	Species.	Proportion to the Phanerog.	Species.	Proportion to the Phanerog	Species.	Proportion to the Phanerog
Leguminosæ . .	51	0·053	70	0·052	212	0·067
Compositæ . .	105	0·109	154	0·114	404	0·129
Gramineæ . . .	80	0·083	107	0·079	215	0·069

The variations are the same as in the preceding case; that is to say, in the same direction, and with a not very different intensity.

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* To avoid a departure from custom, in a circumstance where it was a matter of indifference, I have allowed the weeds of cultivated lands to remain, although they are not, properly speaking, spontaneous, and still less aboriginal species.

It may be objected that the addition to Germany of very different countries, such as Istria, throws too much weight into the scale of the Leguminosæ and Compositæ. There will always be some analogous circumstance in the consideration of a very extensive country, but the following proportions show that without quitting Germany the same facts may be observed. M. Fürnrohr compares the proportions of the families in the environs of Ratisbon and in Germany proper, that is to say, not including Switzerland, Istria, and the province of Prussia. The proportions are as follows, when put into the form here adopted:—

	Ratisbon. (1063 Phanerog.)		Germany. (2906 Phanerog.)	
	Species.	Proportions.	Species.	Proportions.
Leguminosæ	58	0·054	177	0·061
Compositæ . . .	115	0 108	352	0 121
Gramineæ	80	0·073	205	0·070

Authors sometimes compare the proportions of the families in regions as extensive as the whole of Europe, or even still larger. If they happen to compare one of these immense regions with the environs of a town, or with a small island, the error resulting from the relative area of the species may rise to 4 or 5 per cent., or probably even more in some exceptional regions and for certain families. The influence of this cause will be particularly great in countries where the species change rapidly from one district to the other, as for instance at the Cape, Brazil, Mexico, &c.

Notwithstanding this cause of error and that arising from the unequal degree of frequency of the species, it is certain that for countries of nearly similar extent, and for families in which the average area of the species is not very different, these proportions possess some interest and deserve comparison.

We may also ascertain that certain families have the greater part of their species collected together in a particular region of the globe, without taking any trouble about the proportion which they bear to the whole of the Phanerogamia in each region. This is a mode of looking at the question which sometimes leads to different results.

As a general rule, two characters which it is essential to know may be derived from the study of the families:—

1. In every country certain families *predominate* as regards the proportion of their species. This is the case with the Gramineæ and Compositæ in Europe, the Leguminosæ in the West Indies and most countries in the neighbourhood of the Equator, and the Proteaceæ or Myrtaceæ in Australia.

2. Certain families are *characteristic* by being peculiar to the region under consideration, or at least presenting a greater proportion than in other regions, either with regard to the Phanerogamia of the same region or to the species of each family. Thus, the Berberideæ are characteristic of Chili; the Stylidieæ of New Holland; the Resedaceæ of the Mediterranean and adjacent region; the Cactaceæ of Mexico; and the Oxalideæ of Brazil and of the Cape; &c.

The total or nearly total absence of a family in a region, especially when the conditions of climate might lead one to expect that it would occur there, is also a character that must not be neglected.

Lastly, the combination of the families deserves notice, as well as the characters belonging to each in particular. Thus, the vegetation of the island of Juan Fernandez, consisting essentially of Compositæ and Ferns, must present a very different aspect to a vegetation in which the Compositæ are associated with the Leguminosæ, or the Ferns mixed with Aroïdeæ or Orchideæ; and as the principal families combine by threes, fours, &c., Floras of excessively various characters are produced.

3. *Characters relating to the Genera.*

The indication of the genera which include the greatest number of species, or which are most apparent from the number of individuals, is also a mode of depicting the *ensemble* of the vegetation of a country, to which many, even superficial, travellers have paid attention. Unfortunately this character is not susceptible of great precision, and is applied with difficulty to the comparison of one country with another in consequence of the multitude of genera, the want of a complete enumeration of the species of many regions, and the great number of genera which occur in two or more adjacent or even distant regions.

Here, as with the families, we may remark the *predominating* and the *characteristic* genera.

4. *Characters relating to the Species.*

The presence of a species in a country is always a character in itself, but the number of the species is so great, that it is impossible to attend to all the facts of this nature. It is sufficient in general to ascertain,—

1. *The commonest indigenous species*, paying particular attention to the trees and to the species which predominate in the principal stations of the region under consideration.

2. *The remarkable and characteristic species*, that is to say, more or less abundant in the country, but of a nature to strike a botanist, and not existing in the neighbouring countries.

3. *The cultivated species,* especially those which belong to agriculture.

The number of species relatively to the surface may also be ascertained, particularly that of the species peculiar to the country under examination.

The ascertainment of these numerical elements is useful, but their employment requires some previous reflections, to which I shall now direct attention.

5. *Variety or uniformity of Vegetation.*

The vegetable forms in a country may be varied, either by the diversity which they present in different districts, or by the abundance of different forms in each district. In the former case it is advisable to distinguish different regions or zones and to consider them separately. This is done, for example, in mountainous countries, in which several degrees of elevation present plants for the most part different.

When there is an intimate mixture of vegetable forms in the country under consideration, it is necessary to employ statistical processes. The number of different species is calculated, and afterwards their proportions according to genera and families.

In order that these numbers should have an equal comparative value in different countries, and even, I may say, an absolute value, it is necessary to acquire an idea of the mode in which the extent of surface modifies the proportions. At the first glance it is seen that the numbers change according to the size of the country, and that they change in different proportions, as the species, genera and families occupy average surfaces of very different extent. Both theory and observation agree in showing that it would in fact be incorrect to compare numerical proportions founded on regions of too unequal magnitude*.

If, in the environs of a town, on a space of a hundred square leagues, for instance, we find 1000 species of Phanerogamia belonging to 400 genera and to 100 natural families, which gives 10 species, 4 genera, and 1 family for each square league, and also 2½ species for each genus and 10 for each family,—the proportions will be quite different if the circle be extended, even supposing that there is no alteration in the character of the vegetation. We shall arrive much more quickly at the limit of some of the species than at that of the genera, and especially of the families. The species which have disappeared will be replaced by others, more rapidly than we shall meet with new genera or families, in consequence of the relative areas of these groups. Thus, taking a large province in which the supposed town is situated, including, for example, an extent of 1000 square leagues, we shall have perhaps to add 200 species to the Flora, but not more than 2 or 3 genera, and hardly a family; this would give 1·2 species, 0·4 genera, and 0·1 family to the square league of the province, and 2·9 species for each genus, and 11·8 to each family. If the surface be still further extended, and we imagine for example a vast country including this province and several others, making in all 20,000 square leagues, the Flora will perhaps possess 2000 species, 500 genera, and 103 or 104 families. The proportions will be, 0·1 species, 0·02 genera, and 0·005 families to each square league, and 4 species to each genus, 19 to each family. Thus, the more extensive we suppose the surface of a country to be, the greater (the vegetation remaining homogeneous in other respects) will be the diminution in the number of species, genera and families to the square league, and this will take place more rapidly in proportion in groups of higher rank; the larger the country also, the more will the number of species in each genus and family be increased.

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* Many botanists, not much accustomed to the numerical methods, have fallen into this error.

We might confer upon these arithmetical relations the form of more precise general laws, by employing the average values of the areas of the species, genera and families, such as our researches have shown them to be, but this would be of little use, because the different countries and different groups of phanerogamous plants always depart more or less from the average values founded upon the totality. A mathematician would perhaps see with pleasure the changes which the areas combined with the surfaces introduce into the relations, but naturalists prefer a demonstration founded upon particular cases.

With this object I shall compare these Floras, included the one within the other, and of which I have already made use; that of the department of Maine-et-Loire (the ancient Anjou) by M. Guépin (ed. 3. 1845), that of the centre of France, including this department with several others, by M. Boreau, and that of the whole of France according to the 'Botanicon Gallicum' of M. Duby.

After deducting the cultivated species from each work, and reducing the families to a uniformity with those of the 'Botanicon,' I obtain the following numbers:—

	Surface* in leagues.	Species	Genera.	Families.
Maine-et-Loire . . .	365	1304	473	88
Centre of France . .	2600	1530	535	90
France	27,000	3615	739	103

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* The surface of Maine-et-Loire, and that of the departments included in M. Boreau's Flora, are given by the authors themselves. The surface of France in leagues is derived from the new 'Geographical Dictionary' of M. Langlois.

It will be seen that if we regard the numbers of the Flora of Maine-et-Loire as unity, the augmentations are—

	Maine-et-Loire.		Centre of France.		France.
For the surfaces . . =	1	:	7·14	:	73
For the species . . =	1	:	1·17	:	2·77
For the genera . . . =	1	:	1·13	:	1·56
For the families . . . =	1	:	1·02	:	1 16

Calculating then by the square league, we shall obtain for one league—

	Species.	Genera.	Families.
Maine-et-Loire . . .	3·6	1·3	0·24
Centre of France . . .	0·5	0·2	0·03
France	0·17	0 04	0·02

Lastly, the proportion of the species to the genus and family is—

	Species to the genus.	Species to the family.
Maine-et-Loire . . .	2 7	14
Centre of France . . .	2 8	17
France	4·9	35

For each of the fourteen districts of Silesia the number of species to the genus varies betweeen 2·1 and 2·3, and the number of species to the family between 8·2 and 10·1; but for the whole of Silesia the numbers are 2·8 species to each genus and 14·4 to each family (Schneider, die Verth. &c. p. 210), and for the whole of Germany they are 4·2 and 19 (Koch).

I might multiply these examples, but a more general fact will be sufficient for the most complete demonstration. Of course the terrestrial globe is the largest region that we can take into consideration; its surface, deducting the parts covered by water, is 6,825,000 leagues; and if we suppose that there are 200,000 phanerogamous plants, which is one of the highest estimates that has ever been proposed, there would be for each square league 0·029 species, or say 0·03. Now the most restricted and even the poorest localities have an infinitely greater number of species to the square league. Thus, at the summit of the Pic du Midi de Bagnères, there are 71 phanerogamous plants upon a surface of 200 metres (Ramond); in Scotland, on the most monotonous peaty plains, there are from 50 to 100 Phanerogamia in a square English mile; and in the environs of London, which do not possess a great abundance of spontaneous plants, 400 species have been counted in a square mile (Watson, Phytol. 1838, p. 267).

In the entire vegetable kingdom, that is to say, for the whole surface of the earth, there are about 12 species to each genus and 500 to each family, whilst all the separate Floras, even those of large countries, are far from presenting such high numbers.

This will show how troublesome it is to compare the proportions of the species by genus or family, and also the number of species in relation to the surfaces, between countries of very different extent, as for instance between a small island and a continent, an isolated summit or a small alpine zone and a larger subalpine region, or a great northern country. Nevertheless these comparisons have been made even by esteemed authors, but it is always necessary to study methods before employing them, and in nothing is this more true than in statistics.

6. *Analogies with other Floras.*

There are other facts to be ascertained besides the resemblances and differences between the vegetation under consideration and that of adjacent countries, or those with an analogous climate. The relations and differences may exist in all the kinds of characters. We must of course endeavour to lay most stress upon the principal ones, and for this purpose it is necessary to acquire fixed ideas as to the relative value of the characters of vegetation.

II. RELATIVE VALUE OF THE CHARACTERS OF VEGETATION.

Some geographical botanists appear to attach the greatest importance to numerical abstractions, probably on account of the precise form of documents of this nature. I cannot adopt their opinion, and precisely because I prefer exact methods, and exactitude does not always consist in preferring numbers to words, but in giving its true importance to every thing and every point of view.

In endeavouring to comprehend and depict the general vegetation of a country, I should first direct my attention to the characters which strike everybody, and which constitute the principal features of the picture. These characters may sometimes be expressed by figures, and then it is advisable to take advantage of them; but this is not always the case. The ordinary forms of language, if they express matters of greater importance, appear to me to be preferable to numerical characters of the second or third order.

The general division of the soil, into marshes, pasture-land, forests, maritime districts, cultivated lands, &c., appears to me to be the thing which at the first glance furnishes the most just notion of the vegetation of a country. We have not only a physical character, such as the temperature and the humidity of the air, but for the forests and meadows also a botanical character, and one of the most important. If the degree of civilization of the country allows us to ascertain exactly the proportion of these great kinds of *station*, it will be well to give it in a numerical form. In this case the numbers express what is essential to be known, in an exact and condensed form.

After this, I regard it as important to ascertain *the commonest species* in the *stations* which occupy the greatest amount of space, and in particular the social arborescent species, that is to say, those of which the forests are exclusively composed. In highly cultivated countries the indication of the principal agricultural species is almost of equal importance.

In the third degree of importance I should place the *enumeration of the principal genera*, the indication of the *predominant* and *characteristic families*, the frequency or rarity of certain great *physiognomical categories*, such as succulent plants, evergreens, annual plants, &c.

Lastly, I should give the lowest place to the characters which only a botanist can discover, or which result solely from a complete investigation, and from calculations made from books,—such as the indication of *rare species, the proportion of the Dicotyledones to the Monocotyledones, the total number of species, genera and families, that of the species peculiar to the country, and the average number of species to the genera and families.*

The analogies and discrepancies, in relation to other countries, have more or less value according as they repose upon one or other of the characters, of very different degrees of importance, to which I have just referred. These reflections appear to me to be adapted to the guidance of the authors of Floras, and travellers who describe vegetation. They show to the former that there are some numbers which it is useful to calculate, and others that are useless or even deceptive; and to the latter that certain essential facts are not evident on the spot or to the eyes.

PROCEEDINGS OF LEARNED SOCIETIES.

ZOOLOGICAL SOCIETY.

January 24, 1854.—Dr. Gray, Vice-President, in the Chair.

A Monograph of the Genus Ruticilla. By F. Moore.

Genus Ruticilla (Ray), Brehm.

Syn. *Ficedula*, Boie. *Phœnicura*, Swains. *Chaimarrornis*, Hodgs.*

1. Ruticilla phœnicura, Linn.

Syn. *Motacilla phœnicurus*, Linn. S. N. i. p. 335.
Sylvia phœnicurus, Lath. Ind. Orn. ii. p. 511; Gen. Hist. vii. p. 21.
Ruticilla sylvestris, Brehm, Vœg. Deutschl. p. 363. t. 21. f. 4.

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* Altered to *Chaemarrhornis* by Agassiz, in his 'Nomenclator Zoologicus'.

Phœnicura ruticilla, Swains. Class. of B. ii. p. 240. Gould, Birds of Eur. t. 95.

Ficedula phœnicura, Boie, Isis (1822), p. 553.

Phœnicura muraria, Swains. Faun. Bor. Amer. ii. p. 489.

Ruticilla phœnicurus, Bonap. Geogr. Comp. List of B. p. 15, et C. G. Av. p. 296. G. R. Gray, Gen. of B. i. p. 180. Blyth, Journ. A. S. Beng. xvi p. 133, Catal. B. Mus. A. S. Beng. p. 168.

? *Phœnicura albifrons*, Brandt.

The Redstart, Bewick.

Hab. Europe; W. Asia; N. India. In Mus. East India Company.

2. Ruticilla phœnicuroides, nobis.

Forehead, lores, ear-coverts, throat and breast black, extending much lower down on the latter than in *R. phœnicura*; crown, neck, back and upper wing-coverts ash, with a rufous tint, the ash palest on the crown; wings brown, with the edges of the exterior webs paler, from breast to vent, under wing-coverts, upper and lower tail-coverts and tail (except the two medial feathers which are brown) rufous. Male.

Length, 5 inches; wing, 3, the first primary being a ¼ inch longer, and the second a ¼ inch shorter than in *R. phœnicura*; tail, 2½; bill to gape, $\frac{7}{10}$, more elongated, not so broad at base, and it is also a trifle longer; and tarse, ⅝.

Hab. N. India. In Mus. East India Company.

This species is closely allied to *R. phœnicura*, but is readily distinguished from it in the absence of the white on the front of the crown.

3. Ruticilla tithys, Scopoli.

Syn. *Sylvia tithys*, Scopoli, Ann. i. p. 157. Lath. Ind. Orn. ii. p. 512; Gen. Hist. vii. p. 23.

Ruticilla tithys, Brehm, Vœg. Deutschl. p. 365. Gould, Birds of Eur. t. 96. G. R. Gray, Gen. of Birds, i. p. 180, et Cat. Brit. B. in B. M. p. 62. Bonap C. G. Av. p. 296.

? *Motacilla erythacus*, Linn. S. N. i. p. 335.

? *Motacilla gibraltariensis*, Gmel. S. N. L. i. p. 987.

? *Motacilla atrata*, Gmel. S. N. L. i. p. 988. Lath. Ind. Orn. ii. p. 514 (nec Lath. Gen. Hist.).

The Black Redstart, Eyton.

Hab. Europe; W. Asia; N. Africa.

4. Ruticilla nipalensis, Hodgson.

Syn. *Phœnicura nipalensis*, v. *atrata*, Hodgs. Gray's Zool. Misc. (1844) p. 83.

Sylvia atrata, Lath. Gen. Hist. vii. p. 26 (nec Gmel. et Lath. Ind. Orn.).

Phœnicura atrata, Jard. et Selby, Ill. Ind. Orn. t. 86. f. 3. Sykes, P. Z. S. (1832) p. 92. Jerd. Madras Journ. x. p. 267. Blyth, Journ. A. S. Beng. xi. p. 190.

Ruticilla atrata, G. R. Gray, Gen of Birds, i. p. 180. Hodgs. Cat. B. of Nep. p. 68.

Ruticilla indica, Blyth, Catal. B. Mus. A. S. Beng. p. 168 (1850). Bonap. C. G. Av. p. 296.

Black Indian Redstart, Jard. et Selby.

Thirt-hira (i e Shaker), Hind., Jerdon

Thirthir Kumpa, Plains, Royle

Phirrā or *Jālgārdi*, Beng., Dr. F. (Buch.) Hamilton, MS. ii. p 94.

Hab. India generally. In Mus East India Company.

"This species is very common in most parts of India during the cold weather, but more so in the table-land, I think, than in the Carnatic. It is solitary, frequenting wooded places, gardens, hedges, old walls and out-buildings, being often seen about the roofs of houses. It feeds on the ground, on wasps, ants, and various other insects. Has a most peculiar quivering motion of its tail, especially after feeding."—*Jerdon.*

5. RUTICILLA HODGSONI, nobis.

Syn. *Phœnicura ruticilla*, Hodgs. Gray's Zool. Misc. (1844) p. 82 (nec Swains.).

Ruticilla Reevesii, Hodgs. Cat. Birds of Nepal, p. 67 (nec J. E. Gray).

Phœnicura Reevesii, Blyth, Journ. A. S. Beng. xii. p. 963 (nec J. E. Gray).

Ruticilla erythrogastra, Blyth, Cat. B. Mus. A. S. Beng p. 168 (nec Guldenst.).

Tharcapni, Nepal, Hodgson.

Hab. Nepal. In Mus. East India Company.

Male: forehead, lores, ear-coverts, throat and breast black, fore part of crown clear white (much narrower than in *R phœnicura*), hind part of crown, neck, back and upper wing coverts fine ash, lightest on the crown, wings above dusky brown, the exterior margin of the basal half of the secondaries white, forming a patch; from the breast to vent, under wing-coverts, rump, upper and lower tail-coverts and tail (except the interior and exterior margins only of the two middle feathers which are dusky brown) rufous. The female may be readily distinguished by a general puffy appearance, and by the relative length of wing, &c.

Length, 6 inches; wing, $3\frac{3}{8}$; tail, $2\frac{4}{8}$; bill to gape, $\frac{6}{8}$; and tarse, $\frac{7}{8}$.

6. RUTICILLA RUFOGULARIS, nobis.

Male: crown and back of neck mixed grey and ash; lores, ear-coverts and sides of neck black, wings and medial tail-feathers dark brown; apical margin of the exterior web of the outer tail-feather dusky; smaller wing-coverts (except the feathers immediately on the shoulder), scapulars, basal portion of the speculars, and apical margins of the greater wing-coverts white; exterior margin of the secondaries pale rufescent; throat and breast, back and upper tail-coverts and tail rufous; abdomen, under wing- and tail-coverts pale rufescent. Female: cinereous brown above, rufescent beneath; wings dark brown, margined with pale rufescent; lower part of back, upper tail-coverts and tail rufous, the two medial feathers dark brown, exterior margin of the outer dusky.

Hab. N. India. In Mus. East India Company.

7. Ruticilla erythrogastra, Guldenstadt.

Syn. *Motacilla erythrogastra*, Guldenst. Nov. Comm. Petrop. xix. p. 469. t. 16, 17. Gmel. S. N. L. i. p. 975.

Sylvia erythrogastra, Lath. Ind. Orn. i. p. 503; Gen. Hist. vii. p. 27.

Motacilla ceraunia, Pallas, Zoogr. i. p. 478.

Ruticilla grandis, Gould, P. Z. S. (1849) p. 112.

Ruticilla erythrogastra, Bonap. C. G. Av. p. 296. Gould, Birds of Asia, t. 50.

The Chestnut-bellied Warbler, Lath.

Hab. Cashmere, Kumaon, Nepal (No. 969. *Hodgs. Catal.*). In Mus. East India Company.

"This species frequents the gravelly hollows of the Caucasian torrents during the whole of the summer, and migrates southward, in search of food, on the approach of winter; it runs along the banks of rivers, is restless, but not fearful, often moving its tail while sitting on the low shrubs, it makes its nest among the branches of the sea buckthorn, of the berries of which it is very fond."—*Güldenstadt.*

8. Ruticilla Vigorsi, nobis.

Female: above, head, neck and back cinereous; wings dusky, with paler margins, beneath rufescent; upper tail-coverts and tail rufous, the two medial feathers dusky, as is also the exterior web of the outer and tip of each feather, but paler, bill and legs black.

Length, 7 inches, wing, 4¼, first quill 1½ inch shorter than the second, the third 6⁄10 longer than the second, fourth and fifth equal and longest, the third and sixth equal and but a trifle shorter than the fourth and fifth, the seventh a ¼ inch longer than the second, the eighth ⅛ shorter than the second, tail, 3; bill to gape, 6⁄8; and tarse, 1.

Hab. N. India. In Mus. East India Company.

This may eventually prove to be the female of a species allied to *R. erythrogastra*, but having no white wing-patch.

9. Ruticilla aurorea, Pallas.

Syn. *Motacilla aurorea*, Pall. Zoogr. i. p. 477. Kittl. Kupf. Vœg. t. 26. f. 1. Gmel. S. N. L. i. p. 976. Lath. Hist. vii. p. 92.

Phœnicura Reevesii, J. E. Gray, Zool. Misc. (1832) p. 1. M'Clelland, P. Z. S. 1839, p. 161.

Ruticilla aurorea, G. R. Gray, Gen. of Birds, i. p. 180 (excl. syn.). Bonap. C. G. Av. p. 296.

Lusciola aurorea, Schlegel, Faun. Japon. t. 21 D.

Daurian Warbler, Lath.

Reeves's Redstart, Gray.

Hab. Assam; China; Japan. In Mus. East India Company.

Male: forehead, lores, ear-coverts, throat, fore part of breast, back, upper wing-coverts, apical and basal portion of the secondaries and tertiaries, and the two medial tail-feathers black; exterior margin of the outer tail-feather and apical margin of the rest dusky black; medial portion of both webs of the secondaries and tertiaries white, crown of head and back of neck slaty ash, rather whitish above the ear-coverts, breast, abdomen, under wing-coverts, upper and lower tail-coverts and tail (except as above) rufous. Female· above brown, the wing-patch rufescent white, beneath rufescent, upper and lower tail-coverts and tail (except the medial feathers of the latter which are dusky brown) rufous, bill and legs black.

Length, 5 inches, wing, 3, tail, 2½, bill to gape, ⅝, and tarse, ¾

10. RUTICILLA LEUCOPTERA, Blyth.

Syn *Phœnicura leucoptera*, Blyth, Journ A. S. Beng. xii. p. 962. *Ruticilla leucoptera*, Blyth, Journ A S Beng xvi p 131, Catal. B. Mus. A. S. Beng. p 168 G. R. Gray, Gen of Birds, i. p. 180. Bonap C. G. Av. p. 296

Hab. Malacca; Java. In Mus As. Soc. Bengal.

"Size of *R. phœnicura*, and much resembling in plumage *R. nipalensis*, but smaller and the wings much shorter than in the latter species, it is also generally similar to *R phœnicura*, but has no white on the forehead, which, with the crown, neck, and fore part of the back, are ash-grey, the middle of the back is black, as are also the lores, ear-coverts, throat and breast; and the rest of the under parts, with the rump and tail, except the medial feathers of the latter, are bright ferruginous, the exterior web of the outermost tail-feather being marked with dusky; wings dusky, having a large white patch occupying the base of the secondaries and tertiaries, extending over both webs of each feather, bill and feet black. According to season, the dorsal plumage is margined with brown edgings, the under parts more slightly with greyish, and the wing-coverts with brown. Female plain brown above, paler beneath, with rufous tail, and the same great white wing-patch as in the male.

"Length about 6 inches, of wing, 2¾, tail, 2⅜; bill to gape, ⅝; tarse, ¾."

11. RUTICILLA CÆRULEOCEPHALA, Vigors.

Syn. *Phœnicura cæruleocephala*, Vigors, P. Z. S. 1830, p. 35. Gould, Cent. of Birds, t. 25. f 2 Blyth, Journ. A. S. Beng. xi p. 190. *Ruticilla cæruleocephala*, G R. Gray, Gen. of Birds, i. p. 180. Hodgs. Catal. B. of Nep p. 68. Blyth, Journ. A. S. Beng. xvi. p. 134; Catal. B. Mus. A. S. Beng. p. 168. Bonap. C. G. Av. p. 296.

Hab. N. India. In Mus. East India Company.

12. RUTICILLA SCHISTICEPS, Hodgson.

Syn. *Phœnicura schisticeps*, Hodgs. Gray's Zool. Misc. (1844) p. 83. *Ruticilla schisticeps*, Hodgs. Catal B. of Nep. p. 69, et App. p. 153.

Hab. Nepal (No. 813. *Hodgs. Catal.*).

"Side of the head and neck, back, wings and tail black; top of the head pale slaty blue; throat and large patch on each wing white; lower part of breast and abdomen rufous chestnut.

"Length, 6 inches; wing, 3 inches 4 lines; bill from gape, 7 lines; tarse, 10½ lines."

The only known example of this species is in the British Museum.

13. RUTICILLA NIGROGULARIS, nobis.

Crown of the head slaty blue, lightest on the forehead, lores, ear-coverts, throat, back of neck, back, upper wing-coverts, two middle tail-feathers entirely, and the rest (except the basal portion) black, wings blackish brown, the scapulars, outer edges of the secondaries and under wing-coverts white, breast, flanks, belly, rump, upper and lower tail-coverts and base of tail (except the two middle feathers) bright chestnut; the vent and under tail-coverts have a few white feathers intermixed, bill and legs black.

Length, 6 inches, wing, $3\frac{3}{8}$, tail, $2\frac{6}{8}$, bill to gape, $\frac{5\frac{1}{2}}{8}$, tarse, $\frac{8}{8}$.

Hab. Nepal (No. 813* *Hodgs. Catal.*) In Mus. East India Company.

This species is closely allied to *R. schisticeps*, but differs in having the throat black instead of white.

14. RUTICILLA FRONTALIS, Vigors.

Syn. *Phœnicura frontalis*, Vigors, P. Z. S. 1831, p. 172. Gould, Cent. of Birds, t. 26. f. 1. Blyth, Journ. A. S. Beng. xi. p. 190.

Ruticilla frontalis, G. R. Gray, Gen. of Birds, i. p. 180. Hodgs. Cat. B. of Nep. p. 68. Blyth, Journ. A. S. Beng. xvi. p. 134; Catal. B. Mus. A. S. Beng. p. 168. Bonap. C. G. Av. p. 296.

Ruticilla melanura, Less. Rev. Zool. (1840) p. 265.

Phœnicura tricolor, Hodgs. Gray's Zool. Misc. (1844) p. 83.

Hab. N. India. In Mus. East India Company.

15. RUTICILLA FULIGINOSA, Vigors.

Syn. *Phœnicura fuliginosa*, Vigors, P. Z. S. 1830, p. 35. Blyth, Journ. A. S. Beng. xi. p. 190.

Ruticilla fuliginosa, G. R. Gray, Gen. of Birds, i. p. 180. Hodgs. Cat. B. of Nep. p. 68. Blyth, Journ. A. S. Beng. xvi. p. 134; Cat. B. Mus. A. S. Beng. p. 169. Bonap. C. G. Av. p. 296.

Phœnicura plumbea, Gould, P. Z. S. 1835, p. 185.

Ruticilla simplex, Less. Rev. Zool. (1840) p. 265.

Phœnicura rubricauda, Hodgs. Gray's Zool. Misc. (1844) p. 82 (the male).

Phœnicura lineoventris, Hodgs. MS. (the female).

Hab. N. India. In Mus. East India Company.

"Found along rivers, near or among mountains, haunts rocks just appearing above the torrent. Feeds on coleopterous insects. Continually spreading its tail out like a fan, and in a vibrating manner." —*Griffith.*

16. RUTICILLA LEUCOCEPHALA, Vigors.

Syn. *Phœnicura leucocephala*, Vigors, P. Z. S. 1830, p. 35. Gould, Cent. of Birds, t. 26. f. 1.

Sylvia erythrogastra, var. A, Lath. Hist. vii. p. 28.

Ruticilla leucocephala, Less. Rev. Zool. (1840) p. 265. G. R. Gray, Gen. of Birds, i. p. 180. Hodgs Cat. B. of Nep. p. 68. Blyth, Journ. A. S. Beng xvi. p. 134, Catal. B. Mus. A. S. Beng. p. 169. Bonap C G. Av p. 296.

Chaimarrornis leucocephalus, Hodgs. Gray's Zool. Misc. (1844) p. 82

The White-capped Redstart

Gir-Chaondeea, Hind., Hardwicke.

Kalee phoha, Mohun Ghats, Royle.

Hab. N India. In Mus. East India Company.

"This species is extremely common in the valley of the Dhoon, and also in the hills, along the banks of streams and rivers, flitting from rock to rock and stone to stone, and eternally shaking and spreading its tail."—*Hutton.*

17. RUTICILLA ERYTHRONOTA, Eversman.

Syn. *Sylvia erythronota*, Eversm. Addend Pallas, Zoogr. Fasc. ii.

Ruticilla erythronota, G R Gray, Gen. of Birds, i. p. 180 Bonap. C. G. Av. p 297.

Hab. Caucasus (non vidi).

ROYAL SOCIETY.

February 15, 1855.—Thomas Bell, Esq , V.P., in the Chair.

Note to a paper entitled "Contributions to the Anatomy of the Brachiopoda," read June 15, 1854 By Thomas H. Huxley, Esq., F.R.S.

My attention having been called within the last two or three days, to an error in my paper on the Anatomy of the Brachiopoda, published in the Annals for October, 1854, I beg to be allowed to take the earliest opportunity of correcting it. At p. 289 of that paper the following paragraph will be found:—

"In 1843, however, M Vogt's elaborate Memoir on *Lingula* appeared, in which the true complex structure of the 'heart' in this genus was first explained and the plaited 'auricle' discriminated from the 'ventricle,' and in 1845, Professor Owen, having apparently been thus led to re-examine the circulatory organs of the Brachiopoda," &c. &c.

Now, in point of fact, though M. Vogt *does* describe and accurately figure the structures called 'auricle' and 'ventricle' in *Lingula**, yet he has not only entirely omitted to perceive their connexion, or to indicate the 'auricular' nature of the former, but he expressly states that the so-called 'hearts' are "simple, delicate, pyriform sacs" (p. 13).

I presume that my recollection of M. Vogt's figures was more vivid than that of his text; for having been unable, notwithstanding repeated endeavours, to re-obtain the memoir when writing my paper,

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* Neue Denkschriften der allgemeinen Schweizerischen Gesellschaft für die gesammten Naturwissenschaften. Band VII.

I felt justified in trusting to what seemed my very distinct recollection of its sense. I had the less hesitation in doing this, as in M. Vogt's subsequently published 'Zoologische Briefe *,' he gives the received interpretation to the parts of the so-called 'hearts' without any indication of a change of opinion.

I make this statement in explanation of what might otherwise seem to be great carelessness on my part, and for the purpose of further pointing out that M. Vogt not having made the supposed discovery, it is quite impossible that Professor Owen's researches should have been suggested by it.

April 26.—Sir Benjamin Brodie, Bart., V.P., in the Chair.

"Observations on the Anatomy and Affinities of the *Phyllirrhoë bucephala* (Peron)." By John Denis Macdonald, Esq., R.N., Assistant-Surgeon of H.M.S.V 'Torch.'

As the true position of Peron's genus *Phyllirrhoe*, and even the very existence of the animals composing it, have been matters of doubt to zoologists, during a late cruise to the Fiji Islands I determined to ply the towing-net with a little more diligence than usual, hoping to obtain a few of these almost hypothetical beings, and was rewarded by the capture of many specimens.

Some were taken in the neighbourhood of Lord Howe's Island, S lat. 31° 31″, E. long. 159° 5″, some near Norfolk Island, S. lat. 29° 2″, E. long. 168° 2″, and others, although in smaller numbers, in different parts of our track They generally made their appearance after dusk in the evening, and presented a great diversity in size, form and other external characters, which is due to changes in the musculai system, a variable amount of pigment-spots, &c. Indeed at first I fully believed that several distinct species had been brought up together, but this idea was abandoned when I observed the most dissimilar forms gradually assume so close a resemblance to each other, as ultimately to render it difficult to distinguish them.

From these facts I am much inclined to think that the three species described by Quoy and Gaimard, viz. *P amboinensis*, *P. punctulata* and *P. rubra*, *P. Lichtensteinii* (*Eurydice Lichtensteinii* of Eschscholtz) and *P. rosea* of D'Orbigny, are all referable to Peron's original species *P. bucephala*.

The body of *Phyllirrhoe* is elongated in form and compressed laterally, presenting for description an anterior and posterior extremity, a right and left surface, and a dorsal and ventral border. The head is surmounted by two lengthy, somewhat flattened and acuminate tentacula; the eyes lie beneath the skin, not being visible externally, and the mouth is in the form of a short truncated proboscis, with a vertical opening. The oval-shaped body is on an average about one inch and a half in length, which is something over twice the measurement from the dorsal to the ventral border taken at the middle or broadest part. The tail is quadrilateral in figure, gradually widening towards its posterior border, which is exceedingly thin. The outer integument is perfectly transparent and lined by muscular bundles, disposed longitudinally, and somewhat more than their own breadth apart. These communicate with one another by oblique branching slips, which thus form a kind of network enclosing long lozenge-shaped spaces. Here and there nerve-trunks of considerable size accompany the longitudinal bundles, dividing off into smaller twigs, which distribute themselves at pretty equal distances in a direction more or less perpendicular to that of the muscular fibres. Scattered about at irregular intervals amongst these structures are numerous reddish-brown pigment-spots, in the centre of each of which a clear vesicle is generally distinguishable. As above alluded to, the actual tint of this pigment, and the relative number of spots deposited within a certain space, determine both the general quality and the depth of colour which are found to vary so much in different specimens of *Phyllirrhoe*.

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* Frankfort, 1851, vol. i. p. 285.

The alimentary canal of this creature consists of a muscular tube lined with mucous membrane, extending without flexure from the mouth to the vent. It commences anteriorly in an oral dilatation, in connexion with which we notice a pair of lateral horny jaws articulated with each other superiorly, and beset with very minute and sharp-pointed teeth along the cutting edge, altogether much resembling those of *Glaucus*, and a lingual ribbon gradually increasing in diameter from before backwards, and supporting a pavement of long, conical, flattened and gracefully curved teeth with fine denticulations at the base. The central series of plates being symmetrical, the large tooth in each takes up a middle position, but in the lateral plates it inclines to the inner side. In some examples I have observed certain lobulated bodies lying in contact with the buccal mass, and which I am disposed to regard as salivary glands. The œsophagus is short, and suddenly expands into a moderately large stomach; and the latter, having received the biliary ducts near its posterior extremity, is continued into the rectum, which passes directly backwards some little distance, and ends in the anus, on the right side of the body, at the union of its posterior and middle thirds. The liver in *Phyllirrhoe* consists of four elongated, tubular, and sacculated portions or lobes, disposed along the borders of the body, two lying above and two below the alimentary canal. Each of the superior hepatic glands opens by a distinct duct into the superoposterior part of the stomach, while the ducts of the inferior ones unite to form a common tube joining it at its infero-posterior part. The opposite or cæcal extremities of the two anterior hepatic lobes end in the neighbourhood of the head, while those of the others extend to within a short distance of the tail. The secreting cells of these organs are of a rounded or polyhedral form, containing, besides the nucleus, a reddish-brown pigment and fatty globules.

Phyllirrhoë possesses a simple systemic heart, consisting of a single auricle and ventricle. This organ lies upon the stomach, between the ducts of the two superior biliary glands; and a large vessel or sinus, with many circular constrictions in its walls, may be traced towards the auricle, bringing back the aërated blood from the hinder extremity of the body. There are no visible respiratory organs, but it is probable that the cutaneous surface permits of the necessary exposure of the blood to the air contained in the surrounding medium.

The nervous system is well developed. The supra- and subœsophageal ganglia, with their commissural chords, form a close ring round the gullet immediately behind the buccal mass. The auditory sacs, which are filled with vibratory otokonia, appear to lie between both sets of ganglia, and the rudimentary visual organs, consisting each of a simple cell containing a refracting globule imbedded in black pigment, are also in contact with the nervous matter. Besides the actual distribution of the nerves given off from the cephalic ganglia, I noticed nodules of neurine lying at the base of the tentacula, communicating by commissural threads, and sending off each a principal nerve to the corresponding tentacle The ganglion-globules were lined with a reddish-coloured pigment, deposited round the vesicular nuclei, and when twigs are given off from the smaller nerves, both the homogeneous neurilemma and the contained nervous matter break up like a dividing vessel, without preserving the individuality of distinct nerve-tubes.

The sexes are combined in *Phyllirrhoë*, the male and female generative openings lying close together on the right side of the body in the inferior gastero-hepatic space, and before the anal aperture. The ovaries lie in the inferior recto-hepatic space, varying in number from two to five, in general. They are dark-coloured, subrotund, and finely lobulated bodies, from the fore part of each of which a very delicate duct arises, and all the ducts unite to form a single tube, with a trifling increase in its diameter This common oviduct, lined by a pavement of transparent epithelial cells, passes forwards beneath the stomach in a flexuous manner, and in the inferior gastero-hepatic space, it first unites with the duct of the testis and again continues its devious course until it ends in the fundus of a much larger tube, whose lining membrane is armed with numerous conical and tooth-like processes, and to this is appended a long cæcal process much resembling the spermatheca of *Helix* for example. The external orifice of the male generative apparatus lies immediately posterior to that of the female organs. The testis is rather small, subglobular in form, and closely connected with a short twisted tube*, much dilated at the middle part, and coated over with a layer of dark pigment-cells. It is with this tube, as above noticed, the small oviduct communicates, in order, as it would seem, to permit of self-impregnation, or to answer some other purpose, with the nature of which we are unacquainted; but there is also an intromittent organ, which, however, I have never seen properly exserted.

As to the affinities of *Phyllirrhoë* with Gasteropods, it may be observed that the animal is bisexual, that the eyes, like those of *Glaucus* and *Ianthina*, are very small and rudimentary, being closely applied to the ganglia of the brain, after the manner of the acoustic sacs, and that both *Phyllirrhoe* and *Glaucus* agree in possessing two lateral horny jaws, articulated with each other superiorly, and bordered with minute conical teeth.

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* I have distinctly traced the homologue of this tube in *Pteropoda*, *Heteropoda*, and the *Gasteropoda* proper.

In the *Glaucidæ*, the branchiæ, which consist of simple papillary projections of the skin, are distributed in an equable manner over the dorsal region of the body; and any deviation from this arrangement would naturally tend, either to a more definite localization, or still further dispersion. It is the latter modification which appears to have taken place in *Phyllirrhoe*; so that its respiratory vessels ramify minutely through the common integument, just as the vascular trunks analogous to those which break up in the pectinate gill, adapted for aquatic breathing, are subdivided, and spread themselves over the smooth walls of the lung-chamber in Pulmonifera.

As respects its affinity to the Pteropods, here too the lateral jaws of *Phyllirrhoë* must be borne in mind, together with the almost complete suppression of the organs of vision. It is worthy of note also, that its acoustic capsules contain otokonia, as in Pteropoda, instead of single globular otolithes like those of *Glaucus*, and there is some reason to believe that the long tentacula, so called, are the homologues of the cephalic fins of Pteropods.

The particular features of *Phyllirrhoë*, expressed in the last paragraph, also serve to distinguish it from the Heteropoda, but it somewhat approximates this order in the general conformation of its body, which is elongated, laterally compressed, and presents a kind of proboscis at the anterior, and a rudder-fin at the posterior extremity. There is also, as it would appear to be, a small remnant of the foot on the inferior thin margin of the body, and the lateral undulatory motion of the animal in the water exactly resembles that of *Cerophora*, or *Carinaria*.

The heart of *Phyllirrhoe*, in common with that of Heteropods in general, holds a dorsal position. The auricle lies posterior to the ventricle, as in *Cerophora* and *Firola*, but the reverse is the case in *Atlanta* and *Carinaria*, the difference being due to the relation which the respiratory surface bears to the heart itself, lying in every case on the auricular side. Moreover it is remarkable that the rectum is directed backwards in the former instances, but turns forwards in the latter, taking an opposite course to that of the circulation through the heart.

It may be observed in conclusion, that in Heteropoda the viscera are closely packed together so as to occupy the smallest possible space, while they are widely distributed through the abdomen in *Phyllirrhoe*; thus, again, calling to mind its relationship to the Pteropoda.

This paper is illustrated with drawings representing the animal described and some of the details of its internal structure.

MISCELLANEOUS.

On Phœnicura Tithys. By Dr. Jordan.

This bird may be regarded as a regular winter visitor to the south coast of Devon, and though local in its distribution, as indeed is also its more frequent congener, in its own peculiar haunts it may be met with every year. Our first acquaintance with it began in 1844, we then shot two specimens, a male on January 4th, and a female on the 10th of the same month; they are apt to keep in pairs during the time of their sojourn with us, a male and female usually frequenting the same spot. For some winters after this, circumstances prevented our searching for the birds; nor did we think the visit was other than an accidental occurrence, especially as the season had been unusually mild, and one of my brothers was fortunate enough to shoot an *Accentor Alpinus* on the cliffs near the same spot upon the 9th of January in the same year. But in 1851 we met with our old friends again, and a splendid male was killed by us on the 30th of January, and a female on the 21st of February We again shot a male bird on the 3rd of January 1852, a female on the 27th of December in the ensuing winter, and another, also a female, on the 26th of December 1853. Its time for remaining with us seems very short, indeed usually to be limited to three months, December, January and February; yet during the late winter one was killed early in November, and my brother shot a female as late as the 23rd of March: this may perhaps be owing to the long duration of the cold weather, or, which is less probable, we may have overlooked its stay in other years. With the single exception of the last-mentioned bird, all our specimens were shot within fifty yards of the same place,—a sheltered cove by the Parson and Clerk rocks; but others have met with it along the whole line of coast from Dawlish to Torquay and Paignton, and as it has occurred at Plymouth, and if my memory does not fail me, at Penzance, and also in the Isle of Wight, the probability is that it might be met with every winter along the whole south-western coast of England. Many are killed every year in the neighbourhood of Teignmouth and Torquay, one was shot on the telegraph wires by the side of the river Teign; but it is usually a coast bird and haunts the cliffs. The female procured on the 23rd of March was killed on some trunks of trees laid upon the beach near the town,—a situation much resembling one in which I often remember seeing them in the summer months at Coblenz, where they were frequently to be found settled on some timber by the banks of the Rhine; they were there abundant, and very tame and domestic in their habits, often perching on the low slate roof of a washhouse in the garden of the Hotel de Belle-Vue.

This last specimen was shot during a snow-storm; this also is an exception to its usual habits, for it rarely exposes itself during inclement or severe weather, and we have seldom seen it except when the sun was shining. It seems always active in the search for Diptera, on which evidently it chiefly feeds; and one reason of its preference for the cove by the Parson and Clerk rocks is, that a collection of the larger olive-leaved seaweeds is generally heaped up there for manure; on this heap, flies abound in mild weather throughout the year. The attachment to locality is however very marked in this species; they will be seen not only in a particular spot, but on a particular stone in that spot, they are fond of perching on some prominent point of rock, and from this they sometimes dart out upon any passing gnat, much after the manner of a flycatcher. Dipterous insects are no doubt their usual food, but in very cold weather they may support themselves on the sand-hoppers (*Talitrus Locusta*), since we have found these in the stomachs of stonechats killed on the beach. The male varies much in the beauty of its plumage, the specimen procured on the 30th of January being much more brilliant than those shot on the 3rd and 4th of the same month. The change may therefore be the commencement of its putting on a nuptial dress, there is however much difference between the other two, and one of them is probably in immature plumage, so that they are not in full feather until the spring.

It is curious to speculate on—why this bird should be a winter visitor and *Ph. ruticilla* a summer guest with us, probably the south coast of England would afford a greater supply of insect food during the depth of winter than could be obtained in Germany; yet this is scarcely sufficient explanation of the fact. Another question worthy of notice is, has this bird been overlooked in former years, or has it only lately been a visitor to our coast? Col. Montagu well explored the south coast of Devon, yet I believe he never met with it; we had frequently searched the shore for birds before 1844, yet we never saw it, nor had it to our knowledge been killed near Teignmouth.

April 30th, 1855,
Queen's Coll., Birmingham.

On the Transmission and Metamorphoses of the Intestinal Worms.

By MM. MILNE-EDWARDS and VALENCIENNES.

On the 30th April 1855, M. Milne-Edwards communicated to the Academy of Sciences of Paris the results of some experiments made by M. Van Beneden, in the presence of MM. Valenciennes, De Quatrefages, Haime and himself, in illustration of his views upon this interesting subject. The object of these experiments was to prove the transformation of the *Cysticercus pisiformis* of the rabbit into the *Tænia serrata* when introduced into the intestines of the dog; and they appear to have been perfectly satisfactory to all the members of the commission with the exception of M. Valenciennes, whose observations upon these phænomena follow those of M. Milne-Edwards.

The *Tænia serrata* is exceedingly common in adult dogs, but is not found in these animals when very young. In his first experiment, M. Van Beneden used two newly-born puppies, and brought them up under exactly the same conditions, except that to one of them a certain number of *Cysticerci* were administered in his food, whilst these worms were carefully kept from the second. The *Cysticerci* were administered at three different times, viz. on the 12th and 23rd of March, and on the 21st April These dogs were killed and opened on the 25th April, when the animal which had eaten no *Cysticerci* was quite free from the *Tænia serrata*, although the lower part of its intestines contained a single worm of a different species, the *Tænia cucumerina* The other dog, to which the *Cysticerci* had been administered, contained three bundles of worms, which were regarded as the *Tænia serrata* by M. Van Beneden and the majority of the other observers The bundle which was furthest from the stomach, and which was considered as proceeding from the first administration of *Cysticerci*, was composed of Tænias which had nearly arrived at the adult state, the other two packets were less advanced, that nearest the stomach being the smallest, and regarded as produced from the *Cysticerci* last administered The same results were obtained from another similar experiment; but as this had been going on for a much longer period (the first injection of *Cysticerci* having taken place on the 18th December), the Tænias situated at the greatest distance from the stomach were not only larger than in the previous experiment, but had the generative organs well developed. In all these cases the number of Tænias found in the intestines was less than that of the *Cysticerci* swallowed, thus, the first dog had received thirty-two, and the second seventy of the Cystic worms, but the former contained only seventeen, and the latter twenty-five Tænias.

M. Van Beneden informed M. Milne-Edwards that he has repeated these experiments no less than thirteen times, and always with equally decisive results. Similar experiments have also been performed by Küchenmeister, Von Siebold*, and Leuckart, and always with the same success.

The objections raised by M. Valenciennes to the deduction drawn by M. Van Beneden and other authors from the observation of the above facts, namely that the *Cysticercus pisiformis* of the rabbit is the larval form of the *Tænia serrata* of the dog, repose principally upon the question of the specific identity of the parasite produced by the administration of the *Cysticerci* to the last-mentioned animal with the *Tænia serrata*, a worm which is so common, that, M. Valenciennes states, it may almost be predicted with certainty, that on opening a dog of four months old and upwards, this parasite will be met with. Previous experiments had proved to M. Valenciennes that the administration of the *Cysticercus pisiformis* to dogs "gives rise to a flattened riband, composed of numerous narrow articulations, and presenting at the first glance exactly the appearance of a Tænioid worm, like the *Tænia serrata.*" M. Valenciennes' observations agree closely with those of Von Siebold already given in this Journal (*l. c. supra*); but he states that the Tænioid worms produced from the *Cysticercus pisiformis* in his experiments never possessed generative organs, and the articulations never exhibited the genital pores situated on tubercles of the true *Tænia serrata**. In the case of the second dog referred to by M. Milne-Edwards, in which adult Tænias furnished with generative organs were found, M. Valenciennes states, that out of the twenty-five specimens of the supposed *Tænia serrata* there were only two in which the generative organs were developed; these he admits to have belonged to that species, but adds, that as the dog was greatly infested with worms of other species, he is by no means convinced that the two specimens of *Tænia serrata* furnished with generative organs were produced from the *Cysticerci* administered. He also remarks, in opposition to the opinion of Van Beneden and others, that the *Cysticerci* are the larval forms of Tænioid worms; that notwithstanding the abundance of the *Tænia serrata* in the intestines of dogs, even in towns, their opportunities of devouring the entrails of rabbits, the only situation in which the *Cysticercus pisiformis* has been found, are exceedingly rare; whilst, with regard to the *Cysticercus fasciolaris* of the rat, which is stated by Kuchenmeister and Siebold to give rise to the *Tænia crassicollis* of the cat, he observes that the cystic worm in question is of very rare occurrence, although the *Tænia* said to be produced from it is to be found in almost every cat.—*Comptes Rendus*, 30th April 1855, p. 997.

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* Annals, N. S, No. 60, Dec. 1852, p. 431.

Note on the Trichomonas vaginalis *of Donné.*

By MM. SCANZONI and KÖLLIKER.

Notwithstanding the numerous published observations on the *Trichomonas vaginalis* described by Donné, the true nature of this creature does not yet appear to be ascertained. Some regard it as an animal and place it amongst the Infusoria (Donné, Dujardin and Raspail), or amongst the Acarina (R. Froriep, Ehrenberg). The most recent observers consider the Trichomonads as epithelial cells detached from the uterus, and deny that they are animal organisms (Lebert, Valentin, J. Vogel, Von Siebold and R. Wagner). For ourselves, we must confess that we were amongst those who doubted the animal nature of *Trichomonas*.

But after having more attentively studied these formations, and the mucus of the generative organs in many individuals, we have ascertained that the mucus of the neck of the uterus never contains Trichomonads, which would not be the case if they were only vibratile cells. We have also seen that the Trichomonads resemble true Infusoria in every respect.

Before proving this last assertion we may say, that Donné's description is very exact. Nevertheless we would particularly insist upon the fact, that the form of the Trichomonads is generally elongated, either ovoid or pyriform, and that their size is very variable (from 0·008 to 0·016 or 0·018 millim.). One of the extremities bears from one to three long flagelliform filaments, of 0·015 to 0·030 millim. in length, and at the base of these there are one or more vibratile cilia, which are generally rather short. The opposite extremity of the body is usually elongated into a tail, or slender style, which is rather stiff, and not contractile, and of which the length is sometimes equal to that of the body. We have been unable to find a buccal aperture, although we have thought we saw a slight oblique groove at the anterior portion which bears the cilia. The interior is finely granular and colourless, without any appearance of a nucleus or of contractile vacuoles. Their movements are very slow when the mucus is diluted with water, or with a weak solution of sugar, for it is rather remarkable that water is very injurious to these animals. When brought in contact with it they swell up, acquire a globular form, and exhibit vacuoles in their interior; the movements of the vibratile cilia still continue for some time, but without energy, so that the animals do not change their place, and they cease to move in a certain time. Such Trichomonads have a tolerably distinct resemblance to vibratile cells, and we suspect that those who have put forward the opinion that these organisms do not belong to the animal series, have been led into error by preparations treated with water. If, on the other hand, *pure* vaginal mucus be examined with the microscope, it is astonishing to see the mobility and vivacity of these little creatures, and no doubt will exist as to their nature.

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* It is to be observed, however, that M. Valenciennes does not inform us of the length of time over which his experiments extended.

We shall conclude by remarking, that we have found Trichomonads in many women, both pregnant and the reverse, healthy and affected with leucorrhœa, and that, in our opinion, this animal has no relation with the venereal principle. Nevertheless it is perfectly true, as pointed out by Donné, that the Trichomonads are never found in a vaginal mucus which does not contain mucous or purulent globules, and that they often occur in great numbers in a yellowish, creamy (not frothy, according to Donné), and very acid mucus. A mucus which contains many of these globules also frequently contains cryptogamic plants closely allied to, if not identical with, the *Lepsothrix buccalis*, Rob. It may consequently be said, that the existence of this parasite is connected with a certain alteration of the vaginal mucus, and that it acquires its greatest development in a truly morbid secretion.—*Comptes Rendus*, 7th May 1855, p. 1076.

NEW WORK BY MR. GOSSE.

Mr. P. H. Gosse has now in the press a 'Manual of British Marine Zoology,' in which will be given the characters of every Class, Order, Family and Genus of our native marine animals, from the sponges upwards, with lists of recognized species, and a figure of each genus.

ON A LUNAR VAPOUR BOW.

To the Editors of the Annals of Natural History.

Sandwick Manse, 16th May, 1855.

GENTLEMEN,—On the 28th April, at 11 P.M., and for an hour or two afterwards at least, we had dense ground vapour; and as the moon was nearly full, and giving good light, a beautiful phænomenon was very bright and striking, which I do not recollect to have seen described, though I have on several occasions seen it here before, and which, for want of a better name, I must call a lunar *vapour* bow, or rather circle. It is formed on the opposite side to the moon, and forms a complete circle, which comes to the very feet of the spectator, with his shadow in the middle of it.

I am, yours very truly,
CHARLES CLOUSTON.

METEOROLOGICAL OBSERVATIONS FOR APRIL 1855.

Chiswick.—April 1. Clear and frosty: overcast. 2. Frosty and foggy: fine. 3. Cloudy: rain. 4. Cloudy and cold: clear and frosty. 5. Slight haze: very fine. 6. Fine. 7. Overcast: very fine. 8. Cloudy and cold: slight rain. 9. Cloudy. 10. Boisterous. 11. Cloudy and boisterous: rain at night. 12. Clear: very fine. 13. Overcast: slight rain: cloudy: fine. 14. Foggy: fine. 15. Overcast. 16. Foggy: cloudless and exceedingly fine. 17. Fine: clear. 18. Fine. 19. Slight haze: fine. 20, 21. Very fine: nights frosty. 22. Cold dry easterly wind. 23. Fine: sharp frost at night. 24. Clear and dry: overcast. 25. Densely overcast: cloudy and cold. 26. Overcast and cold: fine: overcast. 27. Dry haze: fine. 28. Hazy: fine: overcast. 29. Cloudy and cold. 30. Uniformly overcast: cloudy at night.

Mean temperature of the month .... 46°·08
Mean temperature of April 1854 .... 47 ·53
Mean temperature of April for the last twenty-nine years ... 47 ·17
Average amount of rain in April .... 1·59 inch.

Boston.—April 1. Fine. 2. Cloudy. 3. Cloudy: rain P.M. 4. Cloudy. 5—7. Fine. 8. Cloudy: rain A.M. and P.M. 9. Rain: rain A.M.: stormy. 10. Fine: stormy. 11. Cloudy: rain P.M. 12. Fine. 13. Cloudy. 14. Fine. 15. Cloudy. 16—20. Fine. 21, 22. Cloudy. 23, 24. Fine. 25—30. Cloudy.

Sandwick Manse, Orkney.—April 1. Clear A.M. and P.M. 2. Bright A.M.: hazy P.M. 3. Bright A.M.: clear P.M. 4. Clear A.M.: cloudy P.M. 5. Bright A.M.: drops P.M. 6. Rain A.M.: clear, aurora P.M. 7. Showers A.M.: sleet-showers P.M. 8. Snow-showers A.M. and P.M. 9. Rain A.M.: showers P.M. 10. Showers A.M.: rain, clear P.M. 11. Cloudy A.M. and P.M. 12. Rain A.M.: clear, aurora P.M. 13. Bright, solar halo, A.M.: rain, aurora, P.M. 14, 15. Bright A.M.: rain P.M. 16. Sleet-showers A.M.: showers P.M. 17. Cloudy A.M.: cloudy, aurora P.M. 18. Rain A.M.: cloudy P.M. 19. Rain, bright A.M.: showers P.M. 20. Hail-showers A.M.: cloudy P.M. 21. Bright A.M.: clear, fine P.M. 22. Clear A.M.: clear, fine P.M. 23. Bright A.M.: cloudy P.M. 24. Hazy A.M.: cloudy P.M. 25. Damp A.M.: cloudy P.M. 26. Cloudy A.M.: clear P.M. 27. Cloudy A.M.: clear, fine P.M. 28. Bright A.M.: clear, fine, aurora P.M. 29. Clear A.M.: clear, fine P.M. 30. Clear A.M.: damp P.M.

Mean temperature of April for twenty-eight previous years . 43°·48
Mean temperature of this month .... 43 ·20
Mean temperature of April 1854 ... . 44 ·68
Average quantity of rain in April for fourteen previous years 1·83 inch.

Meteorological Observations made by Mr. Thompson *at the Garden of the Horticultural Society at* CHISWICK, *near London;* *by* Mr. Veall, *at* BOSTON; *and by the* Rev. C. Clouston, *at Sandwick Manse,* ORKNEY.

Days of Month.	Barometer.					Thermometer.					Wind.			Rain.		
	Chiswick.		Boston. 8¾ a.m.	Orkney, Sandwick.		Chiswick.		Boston. 8¾ a.m.	Orkney, Sandwick.		Chiswick. 1 p.m.	Boston.	Orkney, Sandwick.	Chiswick.	Boston.	Orkney, Sandwick.
1853. April.	Max.	Min.		9¼ a.m.	8½ p.m.	Max.	Min.		9¼ a.m.	8½ p.m.						
1.	30·382	30·221	30·00	30·23	30·15	48	22	36	40½	36½	ne.	n.	sse.	...	...	...
○ 2.	30·173	29·967	29·86	30·02	29·85	46	27	36	42½	37½	se.	s.	sse.	·02	...	...
3.	29·723	29·566	29·48	29·70	29·64	51	39	38	42	39	s	ese.	ssw	·08	...	...
4.	29·868	29·631	29·40	29·68	29·79	51	23	41·5	42½	41½	ne.	nne	w.	·06	10	...
5.	30·051	30·013	29·65	29·73	29·84	57	33	46	47½	45	w.	w.	w	...	...	·03
6.	30·135	30·119	29·67	29·72	29·66	64	40	52	48	44	nw.	wsw.	w.	...	...	·17
7.	30·120	29·994	29·73	29·80	29·53	60	32	49	44	38	nw.	nw	w.	...	...	09
8.	30·050	29·999	29·63	29·61	29·65	53	38	45	39½	37½	nw	nw.	wnw.	01	...	·27
☾ 9.	29·811	29·404	29·35	29·11	28·76	58	39	47	46	39½	w	sw	w	·01	10	·45
10.	29·301	29·253	28·80	28·52	28·84	54	40	43·5	41	40	w	w.	nnw	·01	...	·30
11.	29·556	29·423	29·08	29·32	29·15	57	42	47	43	40	w	nw	e.	05	...	·15
12.	29·572	29·512	29·09	29·03	29·38	60	46	48	42	38½	sw.	wnw	nw.	·01	03	·21
13.	29·607	29·540	29·20	29·49	29·53	57	39	52	44	37½	s.	ssw	e.	01	...	...
14.	30·002	29·844	29·47	29·57	29·36	62	40	47·5	43	41	w.	wnw.	s.	...	...	·25
15.	30·201	30·091	29·61	29·61	29·55	65	41	54·5	45½	48	w.	w.	sw	...	...	·15
● 16.	30·267	30·219	29·79	29·82	30·09	71	41	53	45½	41	w	wnw	wnw.	...	...	·36
17.	30·343	30·322	29·97	30·32	30·26	65	32	48	46	41½	e.	ne	s.	...	...	...
18.	30·342	30·224	29·98	30·00	29·98	66	23	43	46	45	e.	se	w.	...	...	·29
19.	30·129	30·005	29·75	29·86	29·75	67	36	43·5	46½	43	ne.	se	w.	...	...	·07
20.	30·339	30·162	29·77	30·09	30·36	67	27	47·5	40½	36½	n.	nw.	nw	...	...	·10
21.	30·485	30·474	30·11	30·45	30·43	54	28	44	45	40	e.	n	w.	...	...	...
22.	30·473	30·327	30·17	30·42	30·42	52	28	47	47	43	e.	ene	s	...	...	...
23.	30·503	30·422	30·14	30·43	30·37	60	22	43·5	49½	45½	ne	nw	w.	...	...	...
☽ 24.	30·321	30·174	29·92	30·30	30·30	69	40	47	48	46	n.	nnw	nw.	...	...	...
25.	30·161	30·134	29·80	30·29	30·30	51	27	44	47	43	ne.	nne	ne.	...	...	...
26.	30·230	30·212	29·87	30·24	30·18	57	31	43	45½	40	n.	ne.	se.	...	...	...
27.	30·222	30·091	29·83	30·12	30·12	60	28	46	49	44	n.	nnw.	wnw.	...	...	...
28.	30·063	30·046	29·74	30·18	30·27	57	36	48	49	43½	ne.	ene.	nw.	...	...	...
29.	30·200	30·182	29·86	30·30	30·30	54	41	46	49	44	n.	ne.	sw.	...	...	...
30.	30·222	30·162	29·92	30·32	30·35	53	38	42	47	41½	n.	ne.	n.	...	...	...
Mean.	30·095	29·991	29·6 8	29·875	29·872	58·20	33·96	45·6	45·05	41·36				0·26	0·23	2·89

INDEX TO VOL. XV.

ACHNANTHIDIUM, new British species of, 8
Actinia, on the development of, 78; new species of, 85
Actiniadæ, description of some, found on the coast of Devon, 81.
Actinophrys Sol, remarks on the development of, 211, 285
Adam, Dr. W., on the osteological relations observable among a few species of the bovine family, 309.
Ægosoma, new species of, 137.
Agassiz, L., on a viviparous fish from Louisiana, 209
Algæ, new genera and species of, 332; on the impregnation and germination of the, 346.
Alpine plants, on the geological relations of some rare, 313.
Ambyostoma, new species of, 134.
Ancistrocladus, note on the genus, 149.
Ancylus, new species of, 12, on the British species of, 278.
Anteater, on the size of the red corpuscles of the blood of the, 381.
Apjohnia, on the new genus, 335.
Arachis hypogæa, on the fructification of, 385.
Archer's, T. C., First Steps in Economic Botany, reviewed, 355.
Ascaris, new species of, 69.
Aulacorhamphus, new species of, 390
Babington, C. C., on Hypericum anglicum, 92.
Baird, Dr. W., on some new species of Entozoa, 69; on a new species of Cypris, 380.
Balfour, Prof. J. H., sketch of the late Prof. E. Forbes, 35.
Ballia, new species of, 335.
Barlow, the late W. F., on the respiratory movements of insects, 153.
Bates, H. W., on the natural history and habits of Termites, 310.
Battka, M., on the characters and synonyms of the genus Senna, 147.
Beania mirabilis, on the polype of, 129.
Bellotia, characters of the new genus, 332.
Belvisiaceæ, note on, 371
Benson, W. H., on the genus Camptoceras, and on a new Ancylus, 9; on the genus Opisthoporus, 13; on the presence of an operculum in the genus Diplommatina, and on a new species, 329.
Binney, E., on the structure of some limestone nodules, 154.
Birds of Malacca, 95; on the habits of Indian, 375; of Madeira, on the 430.
Bivalve shells, on the animals of certain genera of, 99.
Blyth, E., on the Indian species of Phylloscopus, 161.
Books, new:—Stainton's Entomologist's Annual for 1855, 53, 356; Morris's Catalogue of British Fossils, 54; Catlow's Popular Conchology, 63; Clark's History of the British Marine Testaceous Mollusca, 349; Sowerby's Ferns of Great Britain, 354; Archer's First Steps in Economic Botany, 355.
Botanical Society of Edinburgh, proceedings of the, 155, 236, 312, 382.
Bothriocephalus, new species of, 76.
Brachiopoda, on the anatomy of the, 456.
Brissopsis, new species of, 185.
Brissus, new species of, 181.
Broderip, W. J., on an original painting of the Dodo, 143.
Brullé, M., on the reproduction of Ligula, 76.
Bubo, new species of, 136.
Bucconidæ, new species of, 292.
Buceros, new species of, 136.
Buist, Dr. G., on the nest of a species of mason wasp, 310.
Burgess, Lieut., on the habits of Indian birds, 375.
Busk, G., on a monstrous oyster-shell, 91.
Caberea Boryi, notice respecting, 129.

Calothorax, new species of, 319.
Campanularia integra, notice respecting, 130.
Camptoceras, on the genus, 9.
Campylorhynchus, new species of, 343.
Catlow's, Agnes, Popular Conchology, reviewed, 63.
Cellularia, new British species of, 129.
Cephaloteæ, note on, 371.
Chamæza, new species of, 344.
Cheletropis, on the anatomy of, 232, 359.
Chlorophyll, on the structure of, 321, 416.
Chrysophyllum, on some gall-like appearances on the leaves of a species of, 382.
Churton, H., on the formation of collections in New Zealand, 140.
Cidaris, new species of, 107.
Cladostephus, on the germination of, 348.
Claparède, E., on Actinophrys Sol, 211, 285.
Clark, W., on Ancylus oblongus and A. fluviatilis, 278; History of the British Marine Testaceous Mollusca, reviewed, 349.
Clarke, B., on the embryo of Nelumbium, 369; on Cephaloteæ and Belvisiaceæ, 371.
Cleghorn, Dr., on the discovery of the gutta-percha plant in Malabar, 382.
Cleland, J., on vegetable placentation, 336.
Chocarpus, on the genus, 200.
Clouston, C., on a lunar vapour bow, 466.
Clusiaceæ, on the structure of the seed in the, 363, 372.
Clypeaster, new species of, 268.
Corotoca, characters of the new genus, 225.
Corynactis, new species of, 314.
Crisp, on the alimentary canal and ova of a cuckoo, 222; on two new species of worms, 223.
Cryptogamia, on the development of the higher, 241.
Culicipeta, new species of, 171.
Curdiea, characters of the new genus, 333.
Curtis, J., on the genus Myrmica and other ants, 151; on the affinities of Hypocephalus, 303.
Cyclanorbis, new species of, 69.
Cyclina sinensis, on the animal of, 77.
Cyclostomacea, on the opercula of certain, 16, 329.
Cymbella, new species of, 255.
Cypricardia rostrata, on the animal of, 101.
Cypris, new species of, 380.
Cyrtonops, characters of the new genus, 139.
Daniell, G., on the habits of Formica nigra, 153.
DeCandolle, M. A., on the characters which distinguish the vegetation of a country, 438.
Delphinus melas, notice of, 218.
Dendrocolaptes, new species of, 223.
Diatoma, new species of, 6.
Diatomaceæ of the South of France and the Auvergne, on the, 1; on some British, 252; on the dots upon the valves of the, 291.
Diatomella, description of the new genus, 259.
Diplommatina, new species of, 329.
Distoma, new species of, 73.
Dodo, on an original painting of the, 143.
Dowler, Dr B., on the discovery of viviparous fish in Louisiana, 206.
Duthiers, L., on the development of Actinia, 78.
Echinoderms, notice of some fossil, 101, 175, 262.
Echinus, new species of, 109.
Emys, new species of, 68.
Entomologist's Annual for 1855, reviewed, 53, 356.
Entozoa, new species of, 69.
Erica, on the structure of the anthers of, 156.
Eunotia, new British species of, 254.
Eupatagus, new species of, 274.
Ferns of Great Britain, notes on some, 150; reviewed, 354.
Fish, discovery of viviparous, 206.
Florideæ, on the germination of the, 348.
Focke, M., on the movements and reproduction of the Naviculæ, 237.
Forbes, the late Prof. E., sketch of the life of, 35.
Formica nigra, on the habits of, 153.
Formicarius, new species of, 344.
Fossils, Morris's Catalogue of British, reviewed, 54.
Fragilaria, new species of, 7.
Fraser, L., on two new birds, 136.
Frog, notice of a marsupial, 158.
Fucus, on the impregnation of, 347.

Galla oxen, on the horns of the, 66.

Gilchrist, Dr., on the geological relations of some rare alpine plants, 313.

Glycimeris siliqua, on the animal of, 99.

Godron, M., on the origin of wheat, 383.

Gomphonema, new species of, 6.

Gordius, new species of, 71.

Gosse, P. H., on artificial sea-water, 17; on a new species of leech, 277; on the structure of the manducatory organs in the class Rotifera, 357.

Gould, J., on the nest and eggs of Menura Alberti, 141; on a new species of Tetraogallus, 143; on new species of humming-birds, 146, 318; on the nests of humming-birds, 157; on new species of birds from South America, 343; on a new species of Musophaga, 381; on a new species of Aulacorhamphus, 390.

Gray, G. R., on new species of Ptilonopus, 158.

Gray, Dr. J. E., on the painted pig of the Camaroons, 64; on the horns of the Sanga, or Galla oxen, of Gibba, 66; on a new genus and some new species of tortoises, 67, 135; on the animal of Cyclina sinensis, 77; on a new species of salamander from California, 134; on a presumed new species of rhinoceros, 142; on a monstrous oyster-shell, 210; on Lottia zebrina and L. Scurra, 238; on the attitudes and figures of the Morse, 339.

Greville, Dr. R. K., on some British Diatomaceæ, 252.

Griffith, Dr. J. W., on the dots upon the valves of the Diatomaceæ, 291.

Grundy, Mr., on the structure of the starch-granule, 386.

Gulliver, G., on Delphinus melas, 218; on the size of the red corpuscles of the blood of the great anteater, 381.

Gulsonia, characters of the new genus, 334.

Gutta-percha plant, on the discovery of the, in Malabar, 382.

Halia, description of the new genus, 128

Harcourt, E. V., on the ornithology of Madeira, 430.

Hardy, J., on some gall-like appearances on the leaves of a species of Chrysophyllum, 382.

Harris, C. S., on the marine vivarium, 130.

Harris, Q., on the vine disease, 236.

Harvey, Dr. W. H., on new genera and species of Algæ, 332.

Heliangelus, new species of, 146.

Helianthea, new species of, 146.

Hemiaster, new species of, 191.

Henfrey, A. H., on the structure of starch, 426.

Henslow, Prof. J. S., on an anomalous oyster-shell, 314, 385.

Hincks, Rev. T., on new species of British zoophytes, 127.

Hogg, J., on the external membrane of the ova of the common salmon, 307.

Homalenotus, on the British species of, 414.

Hooker, Dr. J. D., on the structure of some limestone nodules, 154, on some spherical exostoses developed on the roots of various species of Coniferæ, 311.

Humming-birds, new species of, 146, 318; on the nests of, 157.

Huxley, T. H., on the anatomy of the Brachiopoda, 456

Hydraspis, new species of, 69.

Hydromedusa, new species of, 68.

Hypericum anglicum, remarks on, 92.

Hypocephalus, on the affinities and analogies of, 303.

Insects, on the respiratory movements of, 153.

Jeffreys, J. G., on Swiss Mollusca, 20.

Jenner, C., on the development of some of the higher Cryptogamia, 241.

Jordan, R. C. R., on Actiniadæ found on the coast near Teignmouth, 81; on Phœnicura Tithys, 461.

Kolliker, Prof., on Trichomonas vaginalis, 464.

Laminaria, on the genus, 316.

Leech, new species of, 277.

Leiobunus, on the British species of, 411.

Le Jolis, A., on the species of Laminaria, 316.

Ligula, on the reproduction of, 76.

Limestone nodules, on the structure of some, 154.

Lindsay, Dr. W. L., on the flora of Dumfries, 237.

Linnæan Society, proceedings of the, 147, 303, 363.

Lithodes, new species of, 307.

Lottia zebrina, note on, 238.
Lowe, J., on the structure of the anthers of Erica, 156.
Lunar vapour bow, description of a, 466.
Lycett, J., on Perna quadrata, 427.
Macdonald, J. D., on the anatomy of the Macgillivrayia pelagica and Cheletropis Huxleyi, 232, 359; on the anatomy of Nautilus umbilicatus, 361; on the anatomy and affinities of Phyllirrhoe bucephala, 457.
Macgillivrayia, on the anatomy of, 232, 359.
Malacoptila, new species of, 293
Manouria, on the new genus, 68.
Marine vivarium, on the, 130.
Mason-wasp, on the construction of the nest of a species of, 310.
Meade, R. H., on the British species of Phalangidæ, 393.
Megabunus, on the British species of, 405.
Melosira, new British species of, 259.
Menura Alberti, on the nest and eggs of, 141.
Mermis, new species of, 71.
Meteorological observations, 79, 159, 239, 319, 391, 466
Miers, J., on the genera Pionandra, Cliocarpus, and Pœcilochroma, 196; on the structure of the seed in the Clusiaceæ, 363, 372.
Milne-Edwards, M., on the metamorphoses of intestinal worms, 462
Mohl, H. von, on the structure of chlorophyll, 321, 416.
Mollusca, on the opercula of certain, 16; notes on Swiss, 20, Clark's History of British Marine Testaceous, reviewed, 349.
Monopus medusicola, notice of, 277.
Moore, F., on the genus Ruticilla, 450.
Moore, T., on some ferns in the Wallichian herbarium, 150.
Morris's, J., Catalogue of British Fossils, reviewed, 54.
Muscular fibre, on the development of, in Mammalia, 234.
Musophaga, new species of, 381.
Myrmecophaga jubata, on the size of the red corpuscles of the blood of, 381.
Myrmica, notes on the genus, 151; new species of, 152.
Nautilus umbilicatus, on the anatomy of, 361.
Naviculæ, on the movements and reproduction of the, 237; new British species of, 256.
Neisler, H. M., on the fructification of the Arachis hypogæa, 385.
Nelumbium, on the embryo of, 369.
Nemastoma, on the species of, 412.
Nests of humming-birds, on the, 157.
Notodelphys ovifera, notice of, 158.
Odontidium, new species of, 7, 257.
Opilio, on the British species of, 407.
Opisthoporus, on the genus, 13
Ornithology of Malacca, on the, 95.
Orthosira, new species of, 8, 260
Owen, Prof., on the anatomy of the walrus, 226.
Oyster-shell, on a monstrous, 91, 210, 314, 385.
Palæmon serratus, on the natural history and habits of, 247.
Pentastoma, new species of, 73
Pericosmus, new species of, 195.
Perna quadrata, observations on, 427
Phalangidæ, on the British species of, 393.
Phœnicura Tithys, notes on, 461.
Phyllirrhoe bucephala, on the anatomy and affinities of, 457.
Phylloscopus, on the Indian species of, 161
Pinnularia, new species of, 256.
Pionandra, new species of, 199.
Plants, on the geography of, 438.
Pœcilia multilineata, on the habits of, 206.
Pœcilochroma, on the genus, 205.
Potamochœrus penicillatus, remarks on, 64.
Prawn, on the natural history and habits of the common, 247.
Pringsheim, Dr., on the impregnation and germination of the Algæ, 346.
Psammobia pallida, on the animal of, 99.
Ptilonopus, new species of, 158.
Pupa, new species of, 27.
Pygorhynchus, new species of, 271.
Ransom, Dr W. H., on the impregnation of the ovum in the stickleback, 229.
Regulus, new species of, 432.
Rhinoceros, on a new species of, 142.
Rotifera, on the manducatory organs in the, 357.
Royal Society, proceedings of the, 153, 229, 291, 357, 456.

Ruticilla, monograph of the genus, 450.
Salamander, new species of, 134.
Salmon, on the external membrane of the ova of the common, 307.
Saturnia, new species of, 294.
Savory, Dr W. S., on the development of muscular fibre in mammalia, 234
Scalaria, new species of, 274.
Scanzoni, M., on Trichomonas vaginalis, 464.
Schiodte, M., on some Staphylinidæ found in the nests of Termites, 224.
Schistochlamys, new species of, 315
Schizaster, new species of, 264.
Sclater, P. L, on a new species of Dendrocolaptes, 223, on new species of Bucconidæ, 292
Sea-water, on artificial, 17.
Senna, on the characters and synonyms of the genus, 147.
Senoner, Dr., on natural self-printing, 236
Sertularia, new species of, 127.
Smith, Rev W, on the Diatomaceæ of the South of France, 1.
Sorex, new species of, 238.
Sowerby's Ferns of Great Britain, reviewed, 354.
Spatangus, new species of, 178.
Spathura, new species of, 318
Sphacelaria, on the germination of, 348.
Spirachtha, characters of the new genus, 226.
Stainton's, H T, Entomologist's Annual for 1855, reviewed, 53, 356.
Staphylinidæ, notes on some, 224
Starch-granule, on the structure of the, 386, 426.
Stickleback, on the impregnation of the ovum in the, 229.
Tænia, new species of, 74.
Templeton, R., on a new species of Sorex, 238
Termites, on some particulars in the natural history and habits of, 310.
Testudo, new species of, 135.
Tetraogallus, new species of, 143
Tetrarhynchus, new species of, 74.
Thamnophilus, new species of, 315.
Thompson, W., on a new species of Corynactis, 314.
Thwaites, G. H. K., on the genus Ancistrocladus of Wallich, 149.
Tortoises, new species of, 67, 135.
Trichomonas vaginalis, on the, 464.
Tridacna crocea, on the animal of, 100
Trochilus, new species of, 146.
Valenciennes, M., on the metamorphoses of intestinal worms, 462.
Vaucheria, on the impregnation and germination of, 346.
Vegetable placentation, on, 336
Vegetation in the Crimea, notice of the, 155
Vine disease, remarks on the, 236.
Vivarium, marine, on the, 130
Wallace, A. R, on the ornithology of Malacca, 95
Walrus, on the anatomy of the, 226; on the attitudes and figures of the, 339.
Warington, R, on the habits of the common prawn, 247
Weinland, Dr. D F, on a marsupial frog, 158
Welwitsch, Dr. F., on the vegetation of Sierra Leone, 305.
Westwood, J O., on new species of Saturnia, 294.
Wheat, on the origin of, 383
White, A., on a new species of Ægosoma, and on the genus Cyrtonops, 137; on a new species of Anomourous crustacean, 307.
White, Dr W A., on the vegetation of the Crimea, 155
Wilson, A., on the textile plants of Jamaica, 369.
Woodward, S. P., on the animals of certain genera of bivalve shells, 99.
Worms, intestinal, on the metamorphoses of, 462; new species of, 223.
Wright, Dr. T., on fossil Echinoderms from the Island of Malta, 101, 175, 262
Zoological Society, proceedings of the, 64, 218, 292, 375, 450.
Zoophytes, new species of British, 127.

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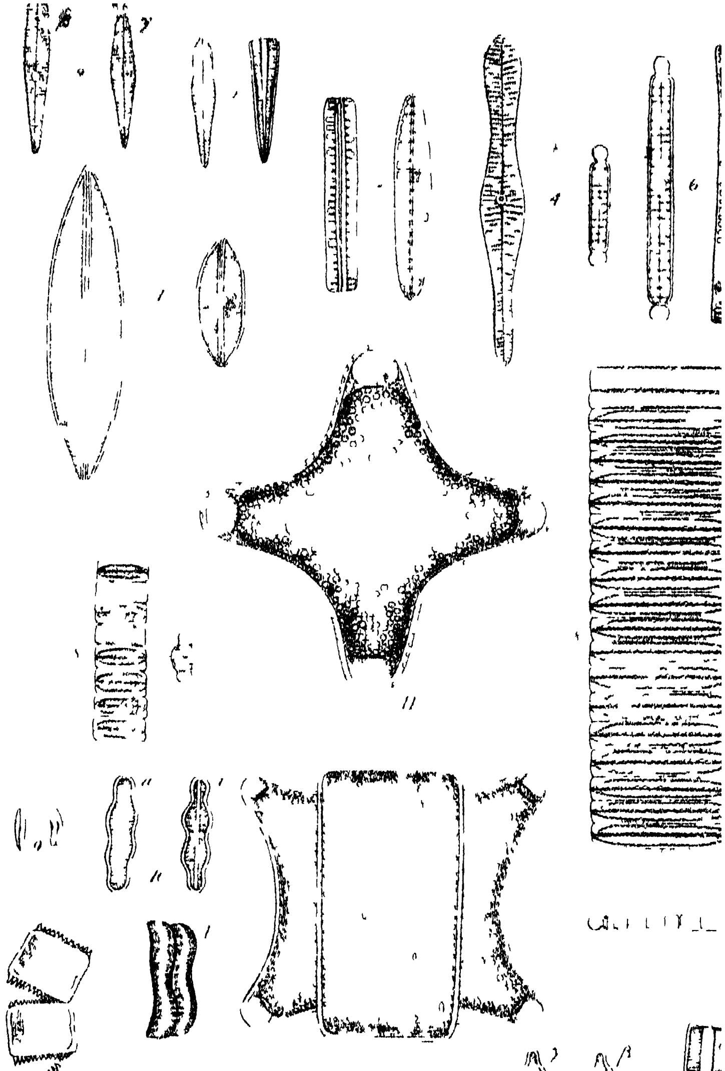
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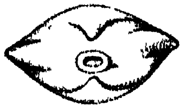
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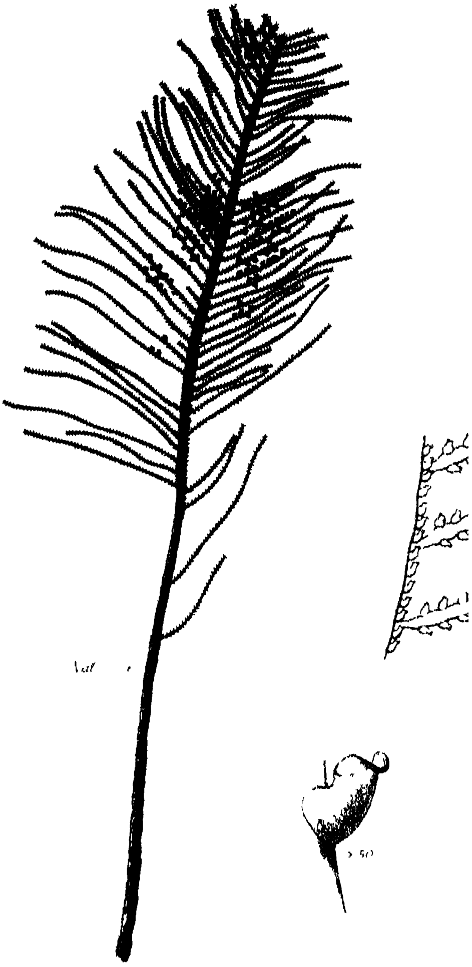
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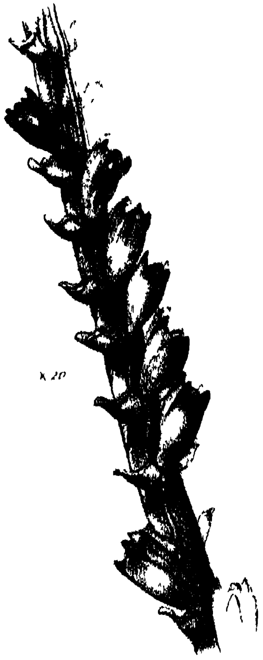
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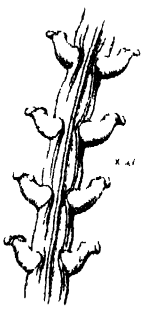
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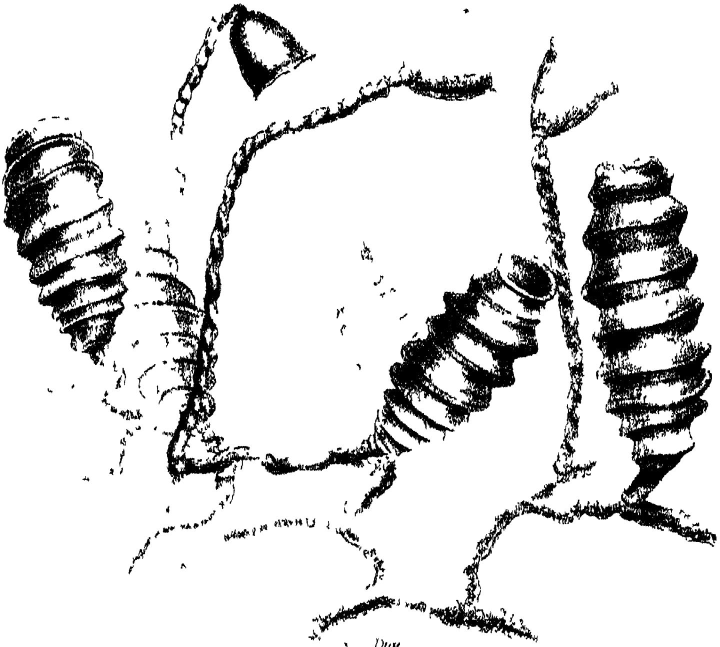

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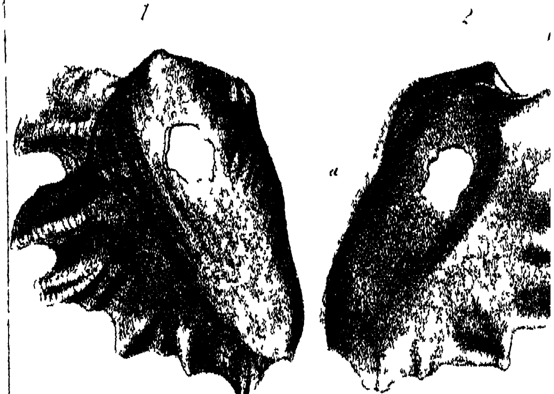

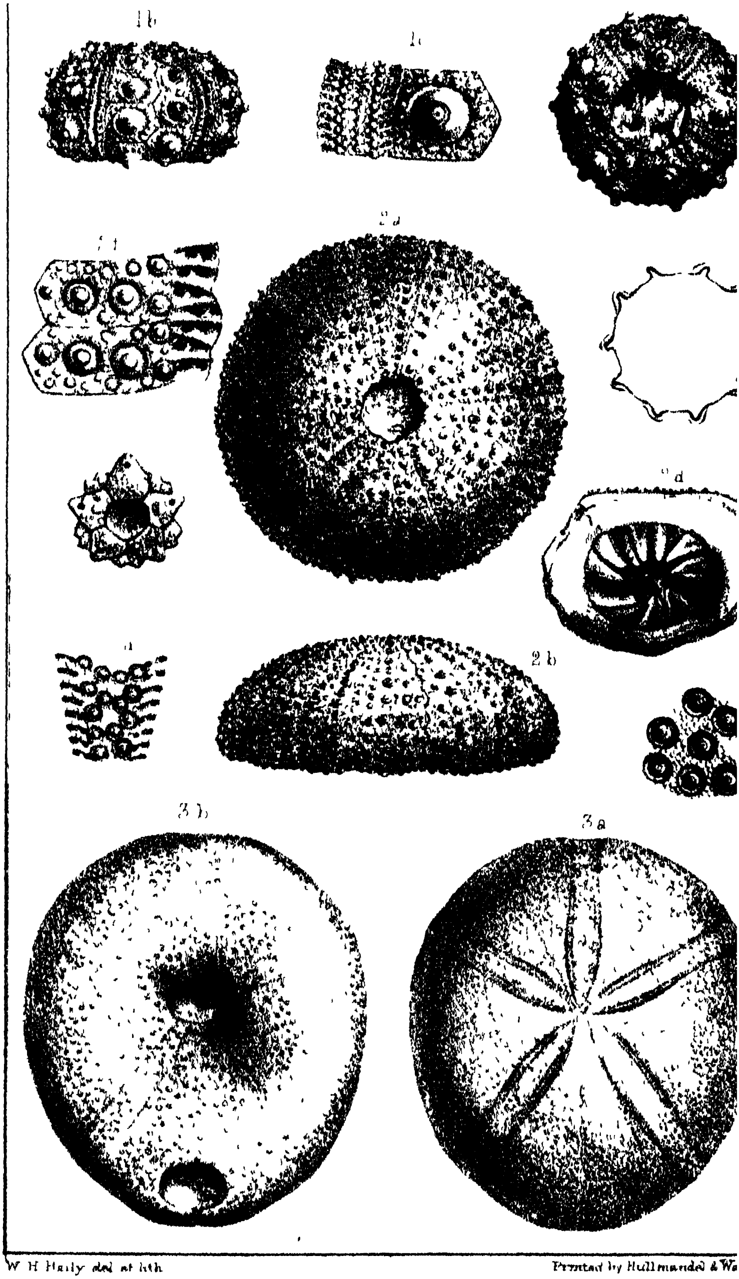

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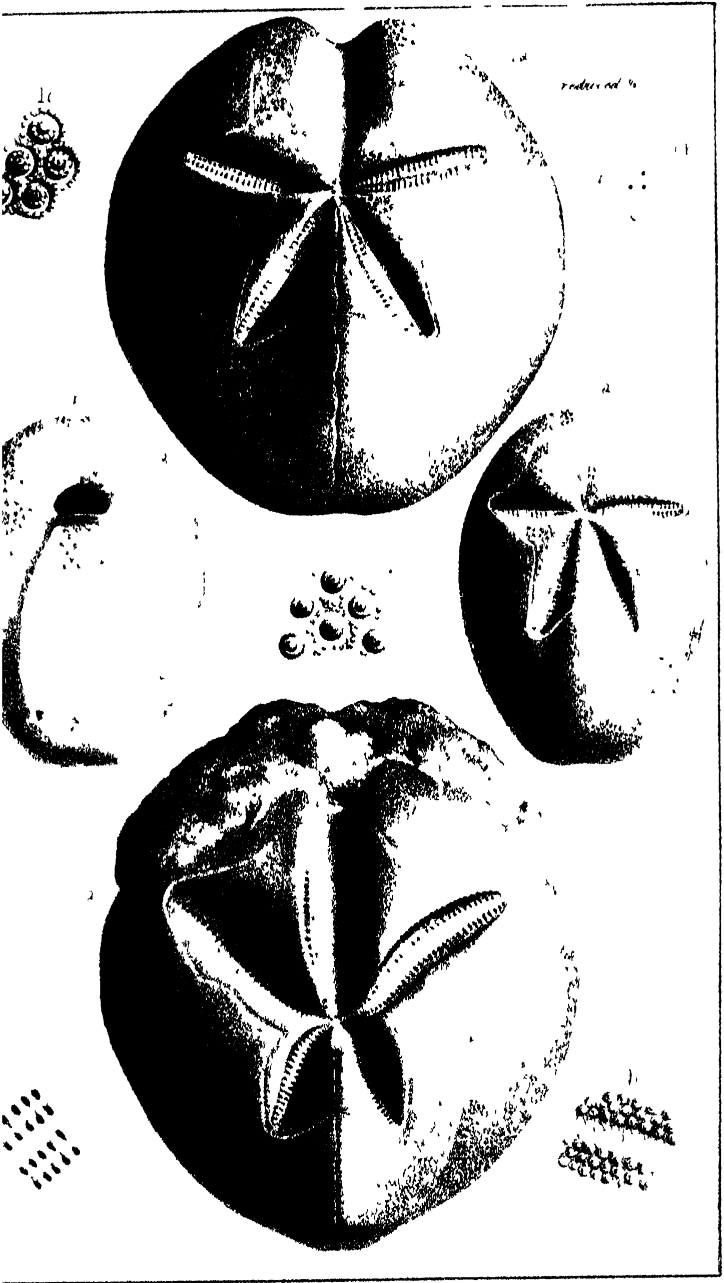

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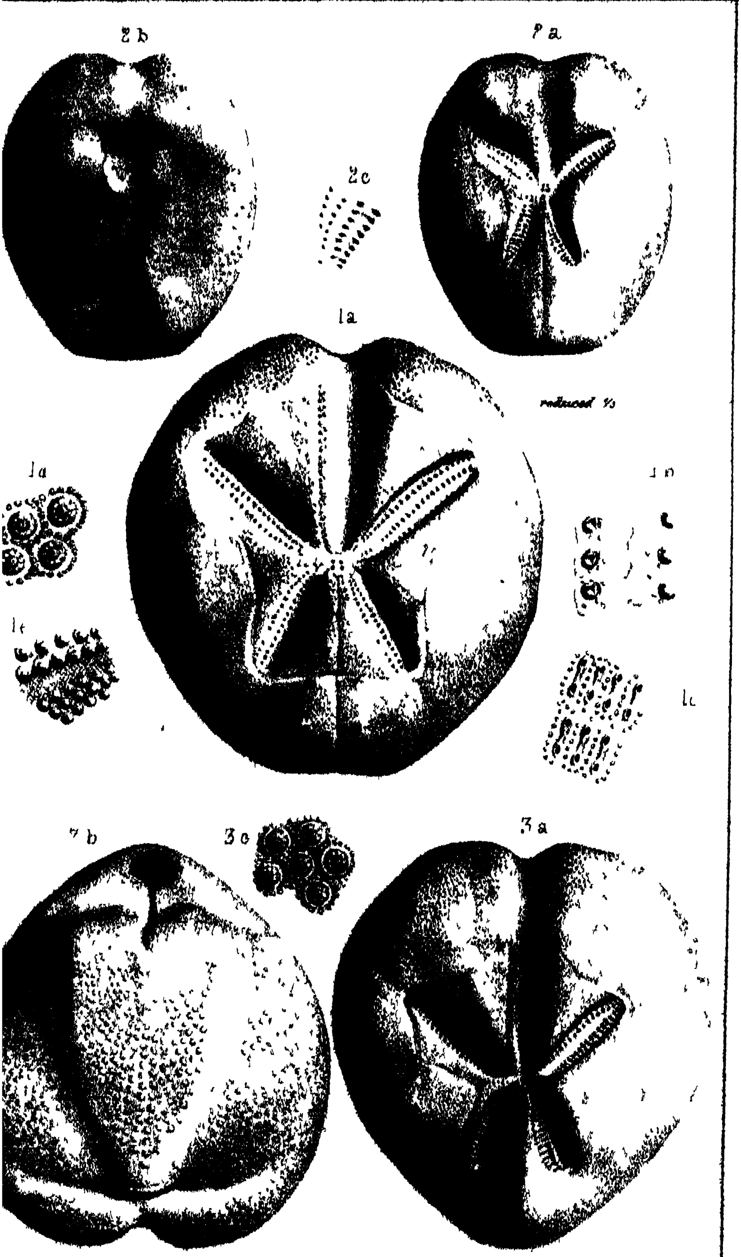

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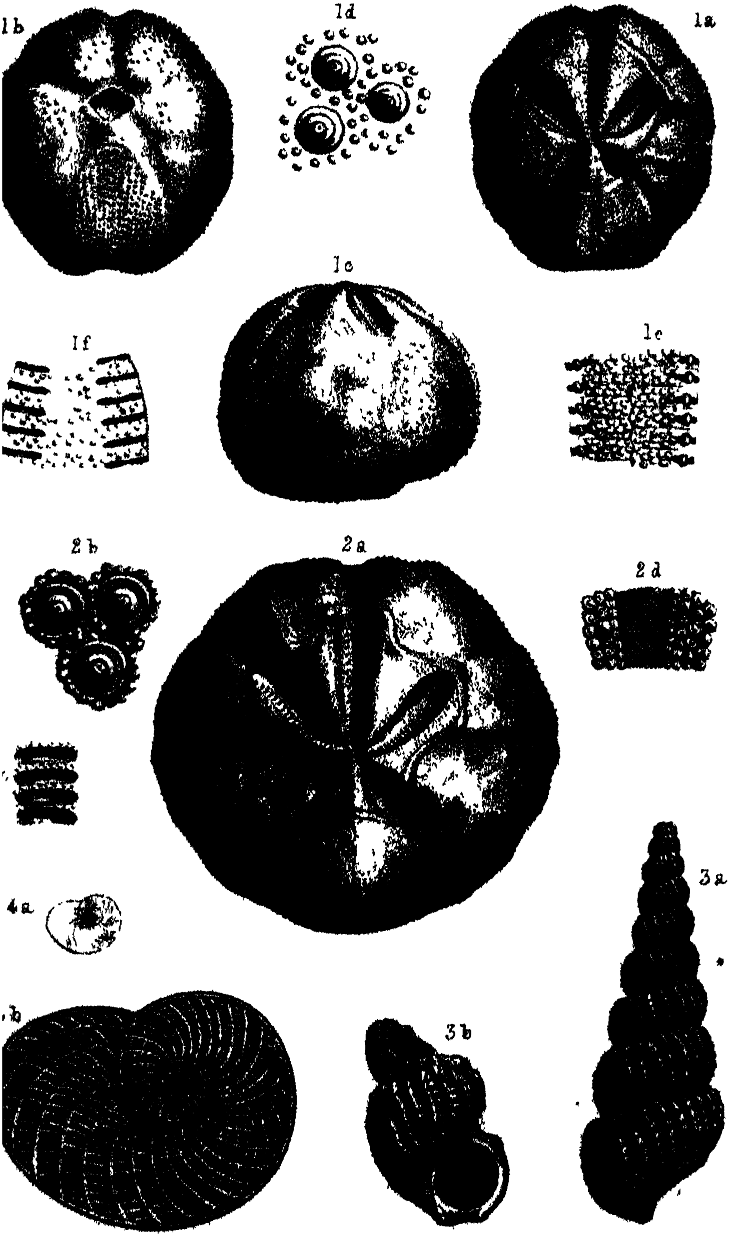

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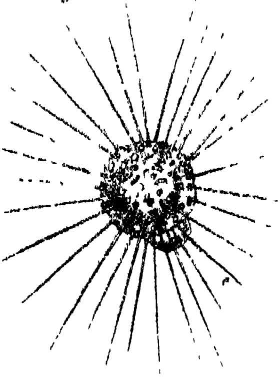

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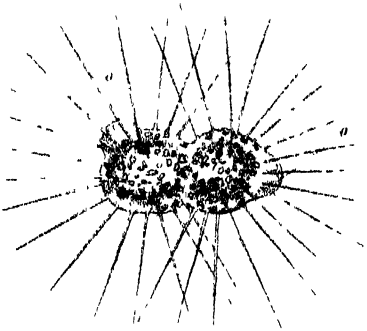

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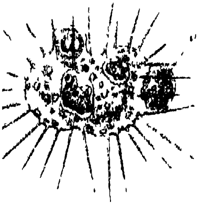

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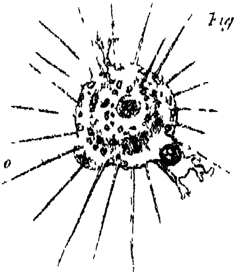

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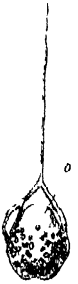

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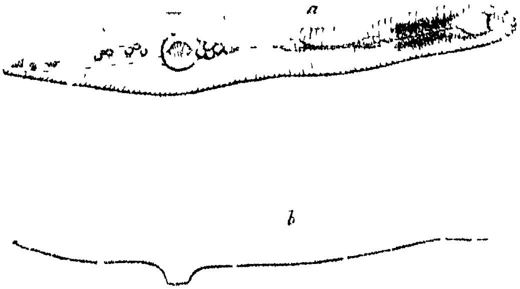

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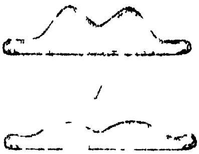

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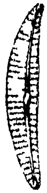

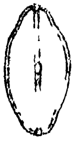

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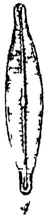

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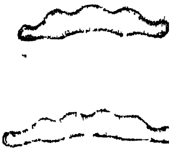

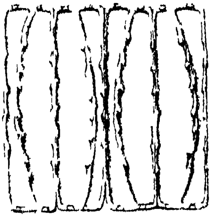

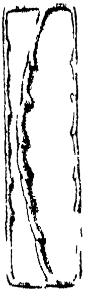

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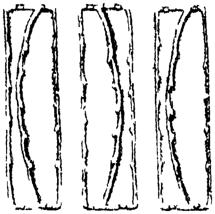

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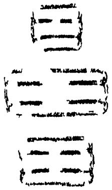

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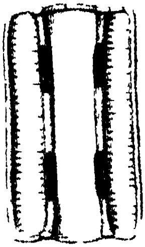

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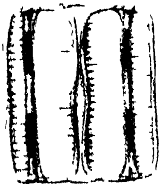

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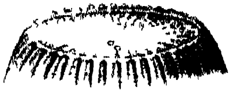

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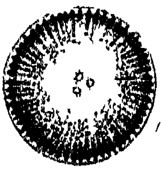

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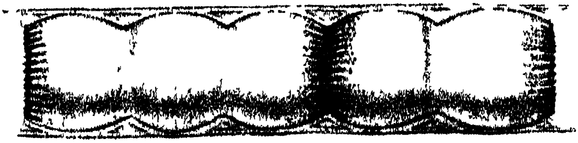

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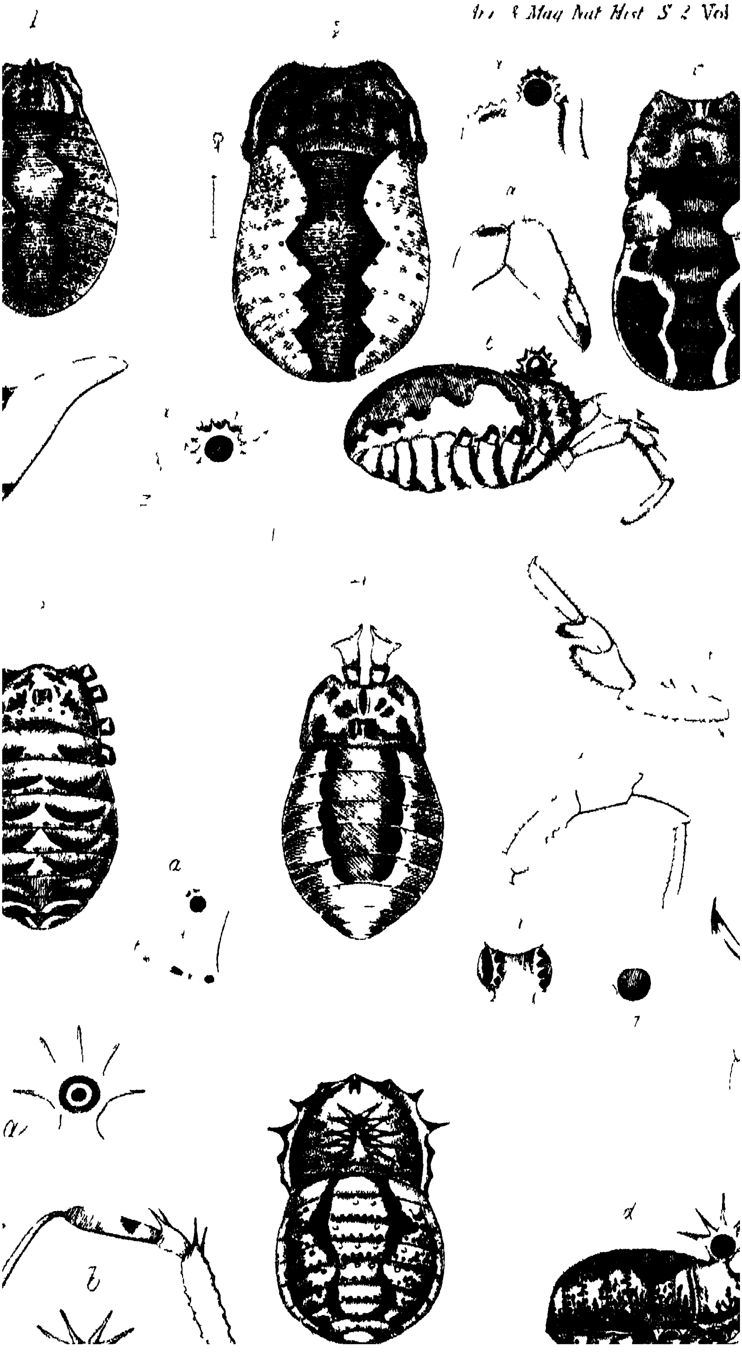
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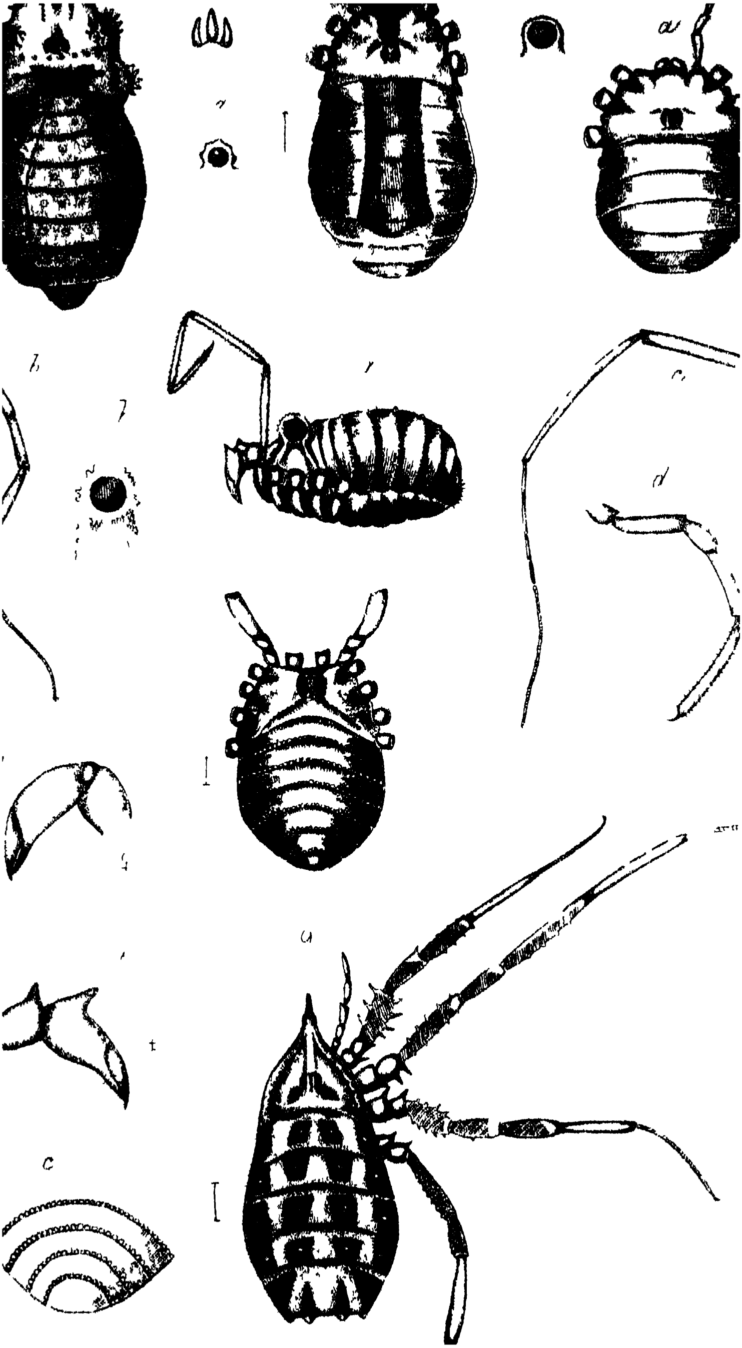
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